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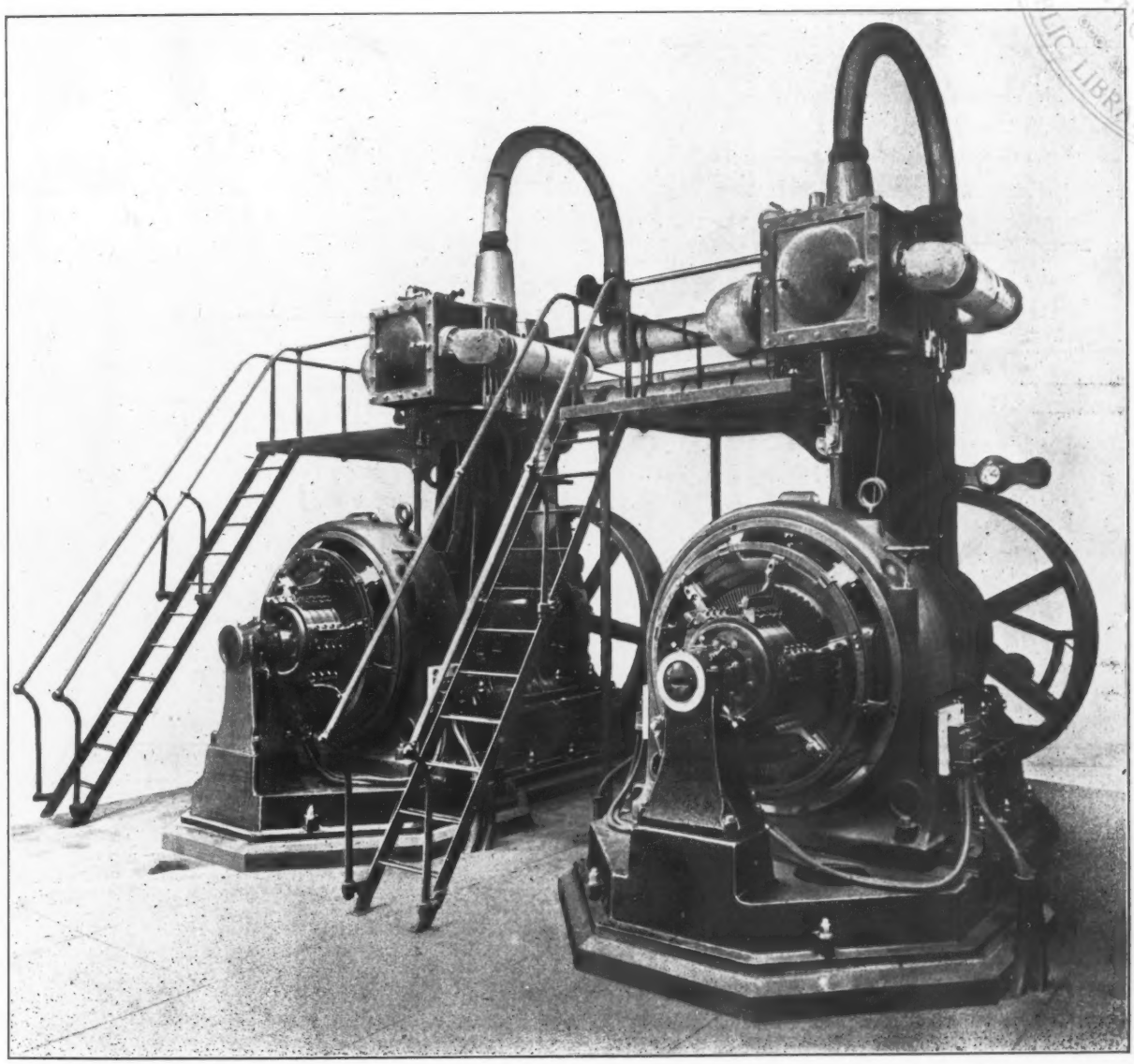
The PRACTICAL ENGINEER

Vol. VI. Philadelphia, August, 1902. No. 7.



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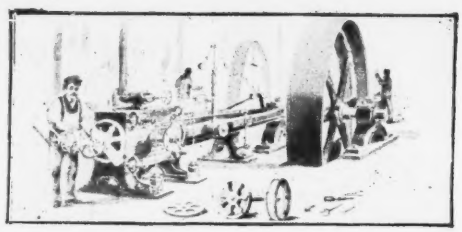

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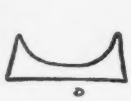

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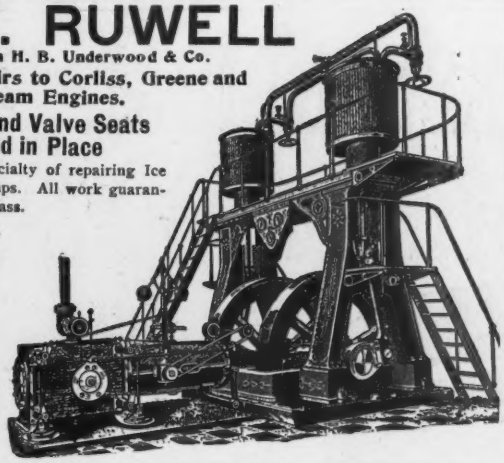

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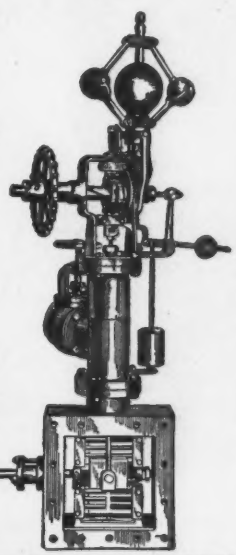

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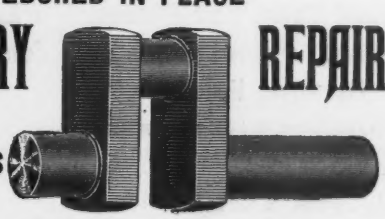

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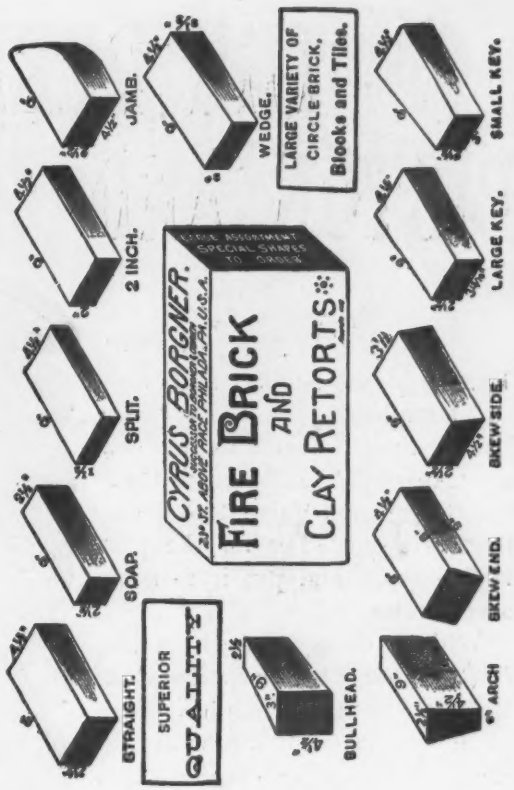

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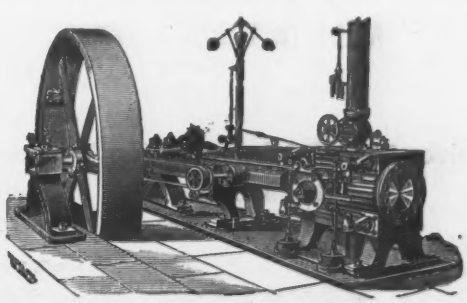

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While in charge of the Escanaba & Gladstone Transportation Co.'s Steamer "Lotus," which has a compound engine and steam at 140 lbs., we ran 22,000 miles on a single packing.

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Chief Engineer, Escanaba Water Works

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The Practical Engineer

THE
OFFICIAL ORGAN
OF THE
AMERICAN ORDER
OF STEAM ENGINEERS

Devoted to the Interests of Stationary Engineers.

VOL. VI. PHILADELPHIA, AUGUST, 1902 No. 7

Oil on "Troubled Waters"

Coal! The name has a significant sound to the engineer just now in view of the scarcity of the article. The great anthracite strike has had an effect upon the manufacturers which will be felt for some time, and there is, no doubt, that ere such a thing occurs again we shall see a great many of the present coal users prepared for the struggle, and that in a manner which bodes ill both for the miner and the operator.

With the unlimited supply of fuel oil, from Texas and other places, has come the application of the oil burner to the steam-boiler. The results attained daily are indeed flattering to the oil people. A number of the Southern railroads have applied the burners to their engines recently because of their inability to obtain the proper quantities of coal to operate with. In every case where this has occurred there has been an economy in the use of the oil; of course this is partly due to the fact that it has only been adopted in those portions of the country directly adjoining the oil fields. But the ease of operating with oil, the certainty of results and the ease with which the present coal burning furnaces can be adopted to the oil burning appliance, places oil as a fuel upon nearly an equal footing with coal. This is a fact that the manufacturers will see, hence we may look for the salesmen with oil burning appliances to receive more than the usual attention.

We may see oil smoothing out the coal troubles of many in the near future, a fact which will be welcomed by the fire-room employees, for with the use of oil as fuel comes a lessening of the back-breaking kind of work heretofore analogous to firing with coal.

At the present time there are insurance restrictions placed upon the use of oil, which in a measure have a restraining influence upon its use, but with the demand will spring up a means of surmounting such minor details.

Determining the Moisture in Steam

In steam-engine or steam-boiler testing, where it is desired to determine with the greatest possible accuracy the steam consumption per horse-power per hour, or the evaporation per pound of coal per hour, it is necessary to take into account the amount of moisture which the steam contains, or as it is more commonly expressed, to find the quality of the steam. If this is not done, or if it is not done accurately, the engine will be charged with steam which it does not consume, and the boiler will show an evaporation of dry steam which is erroneously large. In order to be fair, some method of finding just what part of the evaporation is dry steam, therefore, becomes a necessity.

The steam calorimeter in its various forms is the instrument by which engineers have usually been accustomed to determine the quality of steam. But quite recently the correctness of the usual determinations made by the calorimeter has been questioned, with the result that the instrument has been regarded with a slight amount of disfavor.

This, however, is not really the fault of the calorimeter, for it does its part of the work efficiently and well. It does give the quality of the steam which passes through it. But this is not the point desired. What is wanted is the quality of the steam in the steam pipe, and this is not the same as that indicated by the calorimeter, as a usual thing. For the sample of steam which passes through the instrument rarely represents the steam which is flowing in the pipe.

The whole question, then, seems to be one of obtaining a sample of the steam to pass through the calorimeter which shall represent the conditions of moisture or dryness as they exist in the main pipe. But though this is apparently simple, yet in reality it is a difficult matter.

To begin with, the position of the steam main must be considered. As a usual thing, it is either vertical or hori-

zontal. The direction of this pipe largely influences the method of attachment of the calorimeter, as will be shown.

Suppose the pipe runs horizontally. It is quite natural that most of the moisture which gathers on the inner surface of the pipe should trickle down and collect along the bottom of the horizontal main. Consequently, the steam flowing along the bottom of the pipe contains far more moisture than that in the upper portions of the same pipe. It will not do, therefore, to tap a hole into the under side of the main and introduce a small pipe leading to the calorimeter. For if this small pipe is not screwed in far enough to project beyond the inner surface of the main, the moisture in the bottom of the main will run into it as though it were a drip-pipe, and the calorimeter will show more moisture in the steam than it really possesses.

If the sampling pipe be screwed through so that its upper end comes near the top of the main, it will draw only the drier steam and the calorimeter will indicate less moisture than is actually present in the current. The same thing is liable to occur if the steam is drawn from the centre of the main, or from intermediate points. To obtain as nearly as possible a thoroughly representative sample of steam, a stuffing-box should be attached to the under side of the pipe, through which the sampling pipe should extend. The latter should slide in and out freely in this box, and should have an open end, with no perforations along its length. By means of this arrangement, which is recommended by the Committee on Engine Tests of the A. S. M. E., steam can be drawn from different points in the pipe by adjusting the sampling pipe up and down.

If the moisture in the steam is excessive, as it may easily be if the boiler primes, a separator should be installed along the main between the boiler and the calorimeter, so as to take out the coarser globules of entrained water before they reach the calorimeter, and so have the steam as dry as possible before it is tested.

Where the steam main is vertical in direction, the sampling pipe will, of course, be introduced horizontally, and, if possible, the calorimeter should be attached above a bend and where the steam is flowing upward. The steam, in changing its direction of flow, will deposit some of its moisture on the sides of the pipe, and in flowing vertically upward it will further tend to let fall the heavier particles of moisture.

It will be necessary, in this case, to have the sampling pipe extend beyond the inner surface of the vertical main. If it does not, the moisture trickling down the inside of the pipe will quite likely be drawn into the calorimeter, thus altering the results very largely.

The proper way, in this instance, is to have the sampling pipe extend almost across the main, diametrically, and to have it drilled with a score or more of holes, each one-eighth of an inch in diameter. In this way steam is taken from all portions of the pipe along a diameter, and a good sample for testing is secured.

In conclusion, it does not seem fair to place a stigma upon the steam calorimeter because of inaccuracies in determining the quality of the steam, when the fault really does not lie with the instrument itself, but rather with the method of using it. On the other hand, extreme care should be taken in attaching it to the steam main, so as to obtain results as nearly correct and reliable as conditions will permit.

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Welded Boiler Shells

The facts and figures of the welding of boiler plates into a cylinder in preference to riveting them, is a subject which will appeal to the users of steam-boilers, especially to those who are compelled to use a feed-water containing corrosive elements. The edges of lap joints and rivet heads supply a weak point easily susceptible to the action of all disintegrating acids.

Just why welded joints have not been more frequently brought into use is only problematical. There is no doubt that it would cost considerable money to properly equip a plant with the end in view of welding boiler shells, but then there never has, heretofore, been a time when the American business man balked at an expenditure of money when the results reached promised to justify such expense.

Undoubtedly the subject has never been given the proper thought, by either the boiler-makers or the boiler users.

It is true that welded shells have been made and used (and very successfully too), but only in the nature of experiments, which while successful, were for some unexplained reason never taken advantage of. When one considers the possibilities of imperfect workmanship in the construction of riveted joints, the drifting of rivets, the caulking and the loss in efficiency from punching holes in the plates, the advantages of welding become at once apparent.

Elsewhere in this edition we publish an article which illustrates the methods of welding shells for boiler purposes along with data concerning the proper kind of steel to be used, etc. It is true that circumferential shells that are without the aggregation of plates held together with rivets, are used for pressure tanks, digesters, etc., and in some cases with the heads too welded in, and what is more, each one is giving ample satisfaction.

An advantage to be gained by making the cylindrical shells of boilers seamless, is that they may be rerolled after welding, producing a perfectly cylindrical shell. That is, of course, impossible in a riveted joint. So, also, if a shell could be thus welded, the objectionable two thicknesses of plate in the fire would be removed, together with the trouble incident to the accumulation of deposit which is to form around the joints and rivet-heads; further, if there is no jointed seam, the corrosion caused by the leakage of the lap-joints, or around loose or imperfectly fitted rivets, could not occur.

Reduction in thickness of plates has been advocated if welded joints be used instead of riveted joints, and such reduction in thickness has been placed as much as one-

half; but this is not possible unless a welded joint is known to equal the strength of the original plate, which cannot under any conditions of workmanship be assumed to be true.

The ordinary claims made for perfectly welded joints are, that welding approximates more nearly the original strength of the plates than the best form of riveted joints, relieving the plates from loss of strength due to punching and the additional loss occasioned by drifting and cold hammering. Caulking could be dispensed with, and thus relieve the shell of incipient fractures occasioned by bad workmanship.

\+ + +

The Keystone Telephone Co.'s Plant, Philadelphia

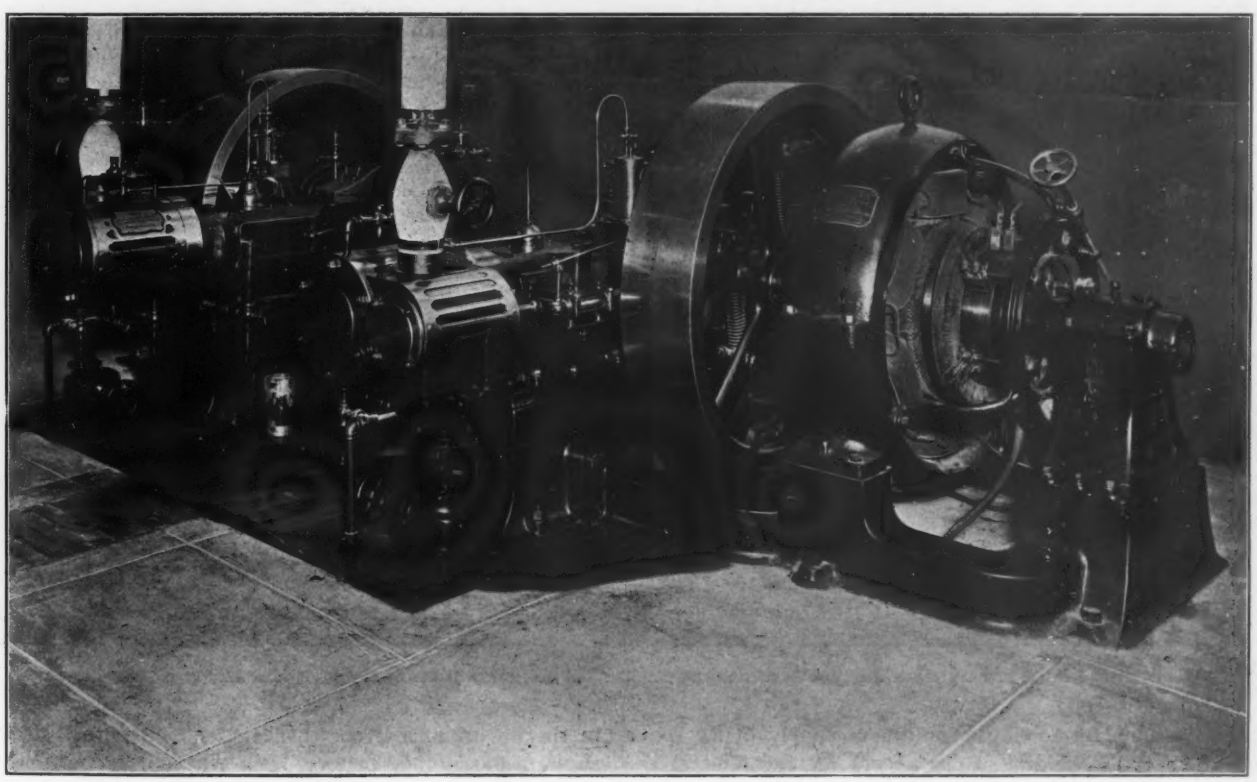
Probably the finest telephone system in the world has but recently been installed in Philadelphia by the Keystone Telephone Company. The capital stock of the Company is $10,000,000. A study of the following description will show the desire of this company to meet all demands which can possibly be made upon them at any time in the future. The Company was formed in April, 1900, and received from the city of Philadelphia during the same month a liberal charter, permitting them to lay conduits, erect poles, run wires, etc. Dr. Louis Duncan was employed to make estimates, plans and get necessary specifications covering a great underground system of over 4,250,000 feet of conduits, covering 75 miles of streets and an installation of 1,250 man-holes. A building was erected at Second and Walnut Streets, 95 by 135 feet in area, and five stories high. In this structure are housed the Company's general offices and the exchange which covers the portion of Philadelphia lying east of Eleventh Street and south of Fairmount Avenue—the heart of the business section of the city. This is known as the main exchange.

At the corner of Sixteenth and Summer Streets the Company have also constructed a building, 45 by 120 feet in area and four stories in heighth, for an exchange to cover that portion of the city below Fairmount Avenue and west of Eleventh Street to the Schuylkill River. Both of these buildings are of brick and terra-cotta and are fire-proof throughout. Both exchanges are of equal capacity, having a maximum of 7,200 lines each.

The apparatus used is the central energy system, manufactured by the Kellogg Switchboard and Supply Company, of Chicago. The station telephone equipment instruments were furnished by the American Electric Telephone Company, Chicago. All of the main cables were furnished by the American Electrical Works, of Providence, R. I.

Among the many twentieth century features adopted by the Keystone Company, and one which will repay them well for the extra expense of installation is that of under-ground wiring. The wisdom of this method of construction was amply demonstrated during the past winter, when the sleet had completely shattered the overhead wire systems, the lines of the Keystone Company remained in perfect working order.

Probably few people know the intricacies of the average telephone system, and in order to thoroughly acquaint the reader with such a vast system as that of the Keystone would consume great space, however, it will be of interest to note the illustrations which are a complete pictorial story of the method of operation from the boiler room to the main switchboard and operating room.



ENGINES AND DYNAMOS IN KEYSTONE TELEPHONE COMPANY'S PLANT, AT 16TH & SUMMER STS., PHILADELPHIA.

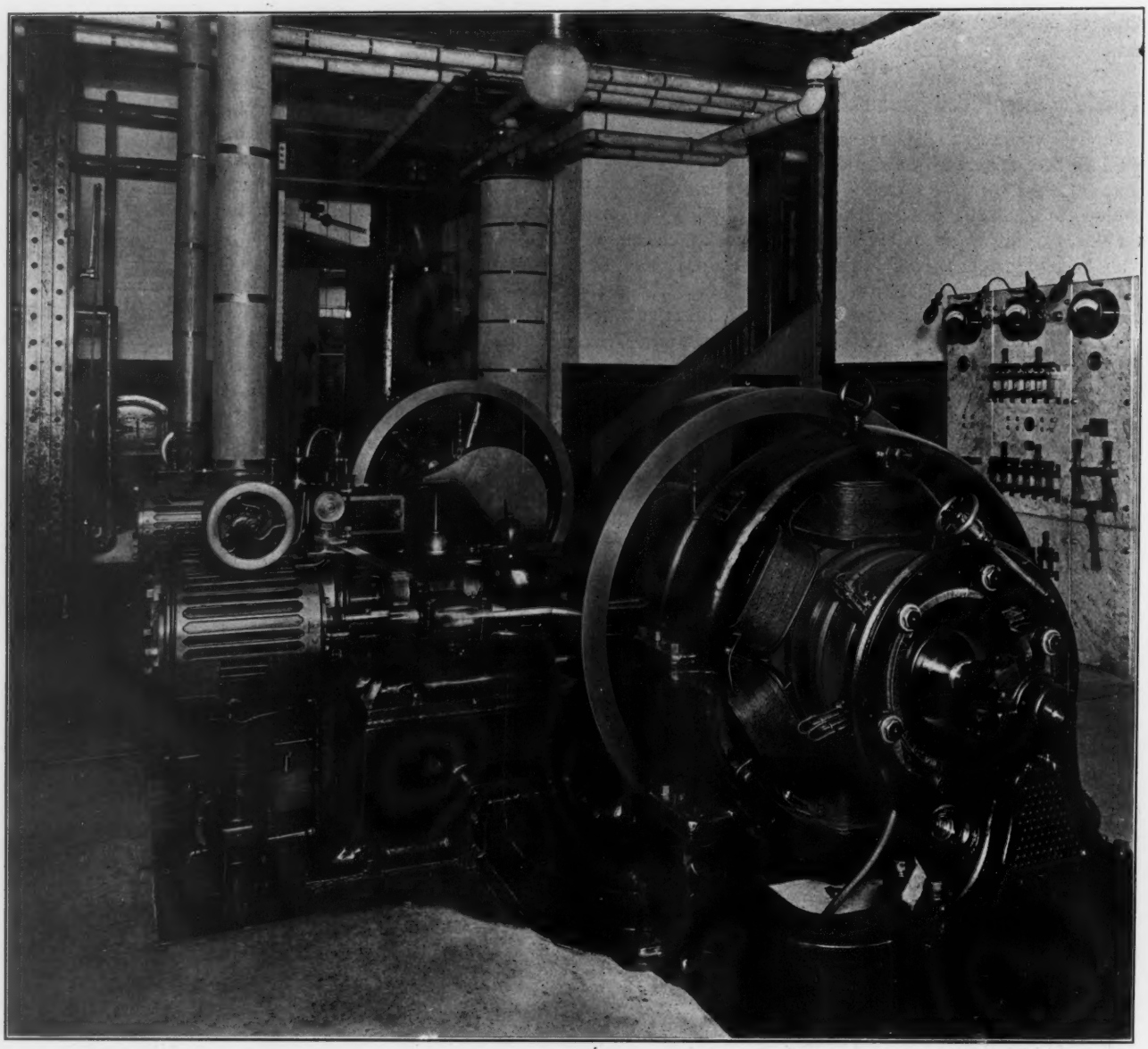
Beginning with the boiler rooms, which supply the steam power for the plants, the Company have supplied both their

exchanges with practically the same equipment. The Sixteenth and Summer Street plant contains two 100 horse-power horizontal tubular boilers manufactured by the E. Keeler Company, Williamsport, Pa. In connection with the boilers are two Roeske charcoal filters and a feed water heater; the heater was supplied by the Stillwell-Bierce and Smith-Vaile Company.

The feed water is supplied through three 4x4 duplex pumps. In addition to the feed pumps there is a circulation pump for forcing a continuous supply of ice water throughout the building, from a cold storage tank in the basement. The elevators are operated by two independent pumps, one a regular duplex pump of the ordinary type for such purposes. The other is a Quimby screw pump, operated by electricity, with the motor so arranged as to enable it to be operated with a current supply from outside sources if any failure should occur in their own plant.

The engines, two in number, were manufactured and installed by the Harrisburg Foundry and Machine Company. They are of the type known as the "standard" single cylinder, single valve engine, 9" by 9" and are run at 300 revolutions per minute. They are each directly connected to a 25 Kilo-Watt Wood system generator, these generators supply the electrical energy for charging the wires of the system as well as light, etc., for the building.

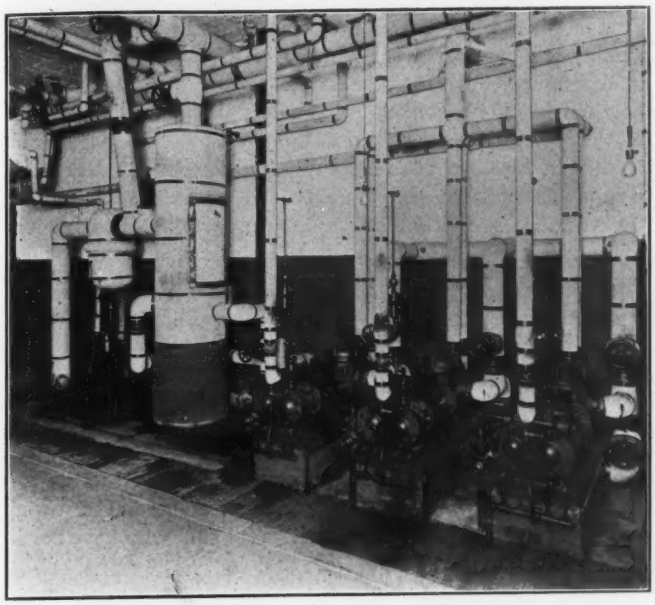
The current is transmitted through the power board, shown in the illustrations, from thence, at a voltage of 230, it is supplied to a storage battery, from which it is transformed, and is supplied to the telephone system at a voltage of 24, which is steadily maintained by the use of motor generators. The switchboard equipment was supplied by the Weston Electrical Instrument Company, Newark, N. J. The valves, steam gauges, etc., are from C. J. Rainear & Company, Philadelphia. All pipes and steam lines are covered with as-



GENERATING PLANT AT MAIN STATION OF KEYSTONE TELEPHONE CO., SECOND STREET, ABOVE WALNUT, PHILADELPHIA.

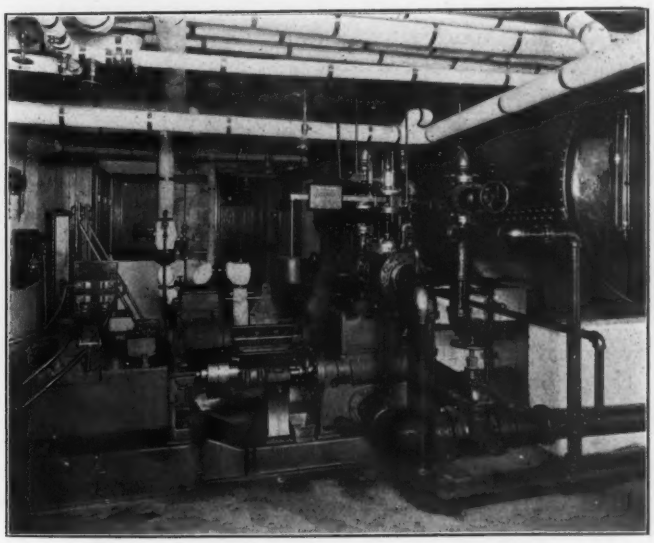
bestos air cell sectional covering attached by R. Willis Lysle, Philadelphia.

A unique and effective system of drainage is effected through the use of a centrifugal pump operated by means of



SHOWING PUMPS, FEED WATER HEATER, ETC., IN 16TH STREET PLANT.

a belt connected electrical motor; all waters and drainage from the building are deposited in a cistern, 4 feet by 8 feet, situated under the floor of the basement, from here the water is forced up to the level of the street sewer by means of the centrifugal pump. So efficient is this pump that it will in 15 minutes completely empty the tank. In order to insure against all danger of flooding, through failure of motive power, this motor is connected to the city electric supply lines in addition to their own system.



ELECTRICALLY DRIVEN CENTRIFUGAL ELEVATOR PUMP AND TANK AT SECOND STREET PLANT.

The Second and Walnut Street plant is constructed upon precisely the same lines except that it is a trifle larger throughout. In addition to the two stations herein described the Company are now erecting in West Philadelphia, Germantown and Kensington, four more stations to operate in conjunction with the present system as soon as they can lay conduits, wires, etc.

During the year it is expected to lay 5,000,000 feet of conduit, covering 120 miles of streets. The accompanying illustrations are made from photographs taken from the two above described and recently completed main exchanges, and show clearly the method of equipment from the engine room to the main switch-board and operating rooms, and give also a good idea of the formation of terminal racks, relay frames and distributing frames.

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Pneumatic Tools and their Uses

BY MAX.

During the past five years the use of pneumatic tools has become almost as extensive in every boiler, bridge, ship, or locomotive shop as is that of the lathe or planer. To-day a shop is not considered up-to-date unless it has an equipment of these tools, and there is probably no class of metal-working tools salesmen who are quite as persistent as the one selling these tools. For this reason the works manager is more perplexed as to which make of tools it is best for him to purchase.

We will first consider the matter of chipping and caulking hammers. Of these there are two distinct types. These are known as the valve tool and the valveless tool.

The valve tool having one or more valves for controlling the admission and exhaust of the air at the front and rear of the striking piston. In the valveless tool there is only one moving part, the piston, which acts as its own valve. Each of these types of tools has its advantages of the other, and each type is more adapted to certain kinds of work than is the other.

The valveless tool, having but one moving part, is much more simple and much less liable to get out of order than is the valve tool. It is much higher speeded than is the valve tool. Owing to its great speed, it is particularly well adapted to the cutting of stone, chipping light or heavy steel and iron castings, and by many is preferred upon caulking, while in the chipping of boiler plates and similar materials, its great speed set up vibrations in these materials, which have not ceased before the next blow is struck, hence the second and each succeeding blow is not as effective as it should be.

In the valveless tool there is difficulty in getting the long stroke which is so effective in chipping of plates and other structural materials. With the valveless tool it is difficult to get the parts so arranged as to keep up the initial air pressure for all or approximately the full length of the stroke. If we were to chip light cast-iron castings with a slow, long stroke-tool, there would be danger of breaking out the metal at just the point where it would be the most essential to save the same. Yet with the rapid short stroke valveless tool this difficulty is nearly if not quite eliminated. While the valveless tool is condemned by many, it can be seen that there is a large field for it in foundries, rolling-mills, etc. Especially is this so with those rolling-mills which chip out all defects in billets. The writer has found that this is not practiced as extensively in this country as in the French and other continental steel-mills. The number of valveless hammers upon the market to-day is somewhat less than of the valve type, there being

practically only three valveless tools upon the market, while with the valve tool there are at least seven different makes.

It is much more difficult to decide between the different makes of valve tools, as to their merits, than it is between the valve and valveless. We all want to get a tool with as few moving parts as possible, and hence we are quite likely to choose that tool which has the least number of moving parts. Yet some of the tools with few moving parts are not what they ought to be. The valves are very light and so constructed that the least particle of dirt will cause them to stick, or hang up, making it necessary to take the hammer to pieces and clean thoroughly before it will work successfully. This means not only loss of time in the cleaning, but loss of the use of the tool while it is being cleaned; also the workman is idle unless we have extra tools in readiness for him to use. So in purchasing valve tools we must see that we are getting a tool which is simple, which is well made, which is least liable to be affected by small particles of dirt, and one which can be easily taken apart and cleaned by a man who is not a skilled mechanic. In doing this, it is best to take the tools apart and decide for ourselves without the assistance of the smooth-tongued salesman. Again, we should not buy a certain make of tool because Mr. So and So says that it is a good tool. We should test its power ourselves, and we should not make a hit-and-miss test as it is so often done. To make this test, securely fasten a piece of boiler-plate of any convenient length and thickness to a bench, or any other solid structure, preferrably ½" thick. After doing this, we are prepared to have one of our men make a cut of a certain length and depth and take his time in doing this. It is also well to weigh the amount of metal taken off, as a small fraction of an inch in depth of cut will often make a decided difference in the results. Be sure and have the same man operate each tool. The matter of grinding of the tools is of the utmost importance. That is, in making this test, all chisels used should have the same bevel. I have seen the entire results of a test reversed by paying attention to this matter. We should also see to it that the air pressure is the same for all tools tested. Not the same at the receiver, but the same at a point near where the hose is attached. We now come to the much argued point of air consumption. It has been our experience that all manufacturers of pneumatic tools are inclined to equivocate a little in this matter. In fact all pneumatic tools use rather more air than they are said to use. It is not so essential to know the exact amount of air used by each tool tested as to know which one of them has used the most air. To determine this, stop the compressor when the pressure has reached a certain point, shut off all connections leading from the receiver, excepting the one leading to the tool to be tested. Then take the time required by each tool to lower the pressure—say ten pounds. We then know which tool uses the most air. In making this test, be sure that the cutting tool is working upon something very solid and that the throttle is kept wide open all of the time.

We now come to the last and to many the most important point, which is the vibration or kick of the tool. This, more than any other one thing regarding pneumatic tools, is controlled by prejudice and error of judgment. For instance, we may be using one or two hammers of a certain make for a year or so when we conclude to put in a larger number of hammers. Before purchasing these, we get sample hammers from the different makers and put them into the hands of our workmen for trial, and right here is where our troubles will commence. Our workmen have, for a long time, been accustomed to the peculiar vibration or kick of the hammer which they have been using; the result is the new hammer has a kick which feels different from the old hammer and the new tool is condemned by the workmen. Yet if the tools had all been put into the hands of an inexperienced man, he would not have been able to distinguish any great difference. Again, the methods of holding the different makes of hammers makes much difference in their vibration. There does not seem to be any rule for holding a hammer which answers for all makes. Yet good results cannot be expected unless the tool is kept well up to the work. The writer has found that a spring balance, which will register up to say fifty pounds, is very essential in testing pneumatic hammers for vibration. By hooking the hook of the balance into the handle of the hammer and taking the thrust of the same by pulling in a direction parallel with the plane of the hammer, we have registered upon the scale the kick of the tool. We have often seen the workmen complain that they did not wish to operate pneumatic hammers as a paralysis of the arm and shoulder would result. Yet in an extensive experience with these tools we have failed to hear of this actually happening, in fact we know of several men who have operated the same for several years and who have never experienced any bad results from so doing.

There is so much chipping and caulking about boiler-shops and ship-yards that it seems almost useless to enumerate the different uses to which these tools can be put. Yet a shop having any considerable amount of work to do should not get all hammers of the same size. Especially is the boiler-maker liable to use a hammer which is too heavy for caulking and tube-beading. I have found this tendency more in Europe than in this country, and more in England than in any other European country. The manufacturers of these tools will be better able to tell you the sizes of tools adapted to different work than you can tell without having any experience with the same. I remember of having seen a pneumatic hammer of British make used in the largest locomotive repair shop in England, and which required two men to operate upon caulking. Yet this hammer was not doing any faster or any better work than an American hammer which would only weigh one-third as much and required only one man to operate. In the use of these tools, the American manufacturer has a great advantage over his British cousins. Here we can put a laborer of ordinary intelligence to run the tool, while across the pond the Labor Unions demand that each tool be placed in the hands of a journeyman. Since my return from there one year ago I understand that this has been modified somewhat.

In the oiling of pneumatic hammers it does not do to use a very heavy oil. If heavy oils are used, the cold produced by the expansion of the air will tend to congeal the same and cause the moving parts to move more slowly.

If many tools are used, it is well to provide a metal tank of sufficient capacity to hold all of them. This tank is to be kept filled with kerosene. All tools are then put in the tanks at night. If possible, have the watchman take these from the tank about one hour before starting time in the morning, and hang up to dry. In this way the tools will be kept free from gum and grit. All tools give the best results with air pressures from 80 to 90 pounds.

In a succeeding article, drills and riveters will be treated.

STANDARD DIMENSIONS OF KEY WAYS FOR SHAFTS FROM 1″ TO 16″ IN DIAMETER

BY JERRY LEAHEY, Jr.

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Adopted by American Order of Steam Engineers in Convention at Reading, Pa., 1902.

DIAMETER OF SHAFT IN INCHES	WIDTH OF KEY WAYS IN INCHES	DEPTH TO CUT IN SHAFT IN INCHES	LENGTH TO CUT END OF SHAFT IN INCHES	DIAMETER OF SHAFT IN INCHES	WIDTH OF KEY WAYS IN INCHES	DEPTH TO CUT IN SHAFT IN INCHES	LENGTH TO CUT END OF SHAFT IN INCHES
1	1 - 4	1 - 8	1 1 - 2	4 3 - 4	1 3 - 16	19 - 32	7 1 - 8
1 1 - 16	1 - 4	1 - 8	1 9 - 16	4 13 - 16	1 3 - 16	19 - 32	7 1 - 4
1 1 - 8	1 - 4	1 - 8	1 5 - 8	4 7 - 8	1 3 - 16	19 - 32	7 5 - 16
1 3 - 16	5 - 16	5 - 32	1 3 - 4	4 15 - 16	1 1 - 4	5 - 8	7 3 - 8
1 1 - 4	5 - 16	5 - 32	1 7 - 8	5	1 1 - 4	5 - 8	7 1 - 2
1 5 - 16	5 - 16	5 - 32	2	5 1 - 16	1 1 - 4	5 - 8	7 9 - 16
1 3 - 8	5 - 16	5 - 32	2 1 - 16	5 1 - 8	1 1 - 4	5 - 8	7 11 - 16
1 7 - 16	3 - 8	3 - 16	2 1 - 8	5 3 - 16	1 5 - 16	21 - 32	7 3 - 4
1 1 - 2	3 - 8	3 - 16	2 1 - 4	5 1 - 4	1 5 - 16	21 - 32	7 7 - 8
1 9 - 16	3 - 8	3 - 16	2 3 - 8	5 5 - 16	1 5 - 16	21 - 32	8
1 5 - 8	3 - 8	3 - 16	2 7 - 16	5 3 - 8	1 5 - 16	21 - 32	8 1 - 16
1 11 - 16	7 - 16	7 - 32	2 1 - 2	5 7 - 16	1 3 - 8	11 - 16	8 1 - 8
1 3 - 4	7 - 16	7 - 32	2 5 - 8	5 1 - 2	1 3 - 8	11 - 16	8 1 - 4
1 13 - 16	7 - 16	7 - 32	2 3 - 4	5 9 - 16	1 3 - 8	11 - 16	8 3 - 8
1 7 - 8	7 - 16	7 - 32	2 13 - 16	5 5 - 8	1 3 - 8	11 - 16	8 7 - 16
1 15 - 16	1 - 2	1 - 4	2 15 - 16	5 11 - 16	1 7 - 16	23 - 32	8 9 - 16
2	1 - 2	1 - 4	3	5 3 - 4	1 7 - 16	23 - 32	8 5 - 8
2 1 - 16	1 - 2	1 - 4	3 1 - 8	5 13 - 16	1 7 - 16	23 - 32	8 3 - 4
2 1 - 8	1 - 2	1 - 4	3 3 - 16	5 7 - 8	1 7 - 16	23 - 32	8 13 - 16
2 3 - 16	9 - 16	9 - 32	3 1 - 4	5 15 - 16	1 1 - 2	3 - 4	8 7 - 8
2 1 - 4	9 - 16	9 - 32	3 3 - 8	6	1 1 - 2	3 - 4	9
2 5 - 16	9 - 16	9 - 32	3 1 - 2	6 1 - 4	1 9 - 16	25 - 32	9 3 - 8
2 3 - 8	9 - 16	9 - 32	3 9 - 16	6 1 - 2	1 5 - 8	13 - 16	9 3 - 4
2 7 - 16	5 - 8	5 - 16	3 5 - 8	6 3 - 4	1 11 - 16	27 - 32	10 1 - 8
2 1 - 2	5 - 8	5 - 16	3 3 - 4	7	1 3 - 4	7 - 8	10 1 - 2
2 9 - 16	5 - 8	5 - 16	3 13 - 16	7 1 - 4	1 15 - 16	29 - 32	10 7 - 8
2 5 - 8	5 - 8	5 - 16	3 15 - 16	7 1 - 2	1 7 - 8	15 - 16	11 1 - 4
2 11 - 16	11 - 16	11 - 32	4	7 3 - 4	1 15 - 16	31 - 32	11 5 - 8
2 3 - 4	11 - 16	11 - 32	4 1 - 8	8	2	1	12
2 13 - 16	11 - 16	11 - 32	4 1 - 4	8 1 - 4	2 1 - 16	1 1 - 32	12 3 - 8
2 7 - 8	11 - 16	11 - 32	4 5 - 16	8 1 - 2	2 1 - 8	1 1 - 16	12 3 - 4
2 15 - 16	3 - 4	3 - 8	4 3 - 8	8 3 - 4	2 3 - 16	1 3 - 32	13 1 - 8
3	3 - 4	3 - 8	4 1 - 2	9	2 1 - 4	1 1 - 8	13 1 - 2
3 1 - 16	3 - 4	3 - 8	4 5 - 8	9 1 - 4	2 5 - 16	1 5 - 32	13 7 - 8
3 1 - 8	3 - 4	3 - 8	4 11 - 16	9 1 - 2	2 3 - 8	1 3 - 16	14 1 - 4
3 3 - 16	13 - 16	13 - 32	4 3 - 4	9 3 - 4	2 7 - 16	1 7 - 32	14 5 - 8
3 1 - 4	13 - 16	13 - 32	4 7 - 8	10	2 1 - 2	1 1 - 4	15
3 5 - 16	13 - 16	13 - 32	5	10 1 - 4	2 9 - 16	1 9 - 32	15 3 - 8
3 3 - 8	13 - 16	13 - 32	5 1 - 16	10 1 - 2	2 5 - 8	1 5 - 16	15 3 - 4
3 7 - 16	7 - 8	7 - 16	5 1 - 8	10 3 - 4	2 11 - 16	1 11 - 32	16 1 - 8
3 1 - 2	7 - 8	7 - 16	5 1 - 4	11	2 3 - 4	1 3 - 8	16 1 - 2
3 9 - 16	7 - 8	7 - 16	5 3 - 8	11 1 - 4	2 13 - 16	1 13 - 32	16 7 - 8
3 5 - 8	7 - 8	7 - 16	5 7 - 16	11 1 - 2	2 7 - 8	1 7 - 16	17 1 - 4
3 11 - 16	15 - 16	15 - 32	5 1 - 2	11 3 - 4	2 15 - 16	1 15 - 32	17 5 - 8
3 3 - 4	15 - 16	15 - 32	5 5 - 8	12	3	1 1 - 2	18
3 13 - 16	15 - 16	15 - 32	5 3 - 4	12 1 - 4	3 1 - 16	1 17 - 32	18 3 - 8
3 7 - 8	15 - 16	15 - 32	5 13 - 16	12 1 - 2	3 1 - 8	1 9 - 16	18 3 - 4
3 15 - 16	1	1 - 2	5 15 - 16	12 3 - 4	3 3 - 16	1 19 - 32	19 1 - 8
4	1	1 - 2	6	13	3 1 - 4	1 5 - 8	19 1 - 2
4 1 - 16	1	1 - 2	6 1 - 8	13 1 - 4	3 5 - 16	1 21 - 32	19 7 - 8
4 1 - 8	1	1 - 2	6 3 - 16	13 1 - 2	3 3 - 8	1 11 - 16	20 1 - 4
4 3 - 16	1 1 - 16	11 - 32	6 1 - 4	13 3 - 4	3 7 - 16	1 23 - 32	20 5 - 8
4 1 - 4	1 1 - 16	11 - 32	6 3 - 8	14	3 1 - 2	1 3 - 4	21
4 5 - 16	1 1 - 16	11 - 32	6 7 - 16	14 1 - 4	3 9 - 16	1 25 - 32	21 3 - 8
4 3 - 8	1 1 - 16	17 - 32	6 9 - 16	14 1 - 2	3 5 - 8	1 13 - 16	21 3 - 4
4 7 - 16	1 1 - 8	9 - 16	6 5 - 8	14 3 - 4	3 11 - 16	1 27 - 32	22 1 - 8
4 1 - 2	1 1 - 8	9 - 16	6 3 - 4	15	3 3 - 4	1 7 - 8	22 1 - 2
4 9 - 16	1 1 - 8	9 - 16	6 13 - 16	15 1 - 4	3 13 - 16	1 29 - 32	22 7 - 8
4 5 - 8	1 1 - 8	9 - 16	6 15 - 16	15 1 - 2	3 7 - 8	1 15 - 16	23 1 - 4
4 11 - 16	1 3 - 16	19 - 32	7	15 3 - 4	3 15 - 16	1 31 - 32	23 3 - 4
				16	4	2	24

NOTE: Length to be cut in end of Shaft is for Leahey's Standard Couplings.

Boilers of the Future

THE FACTS AND FIGURES OF WELDED BOILER SHELLS

It has long been the desire of both makers and users of steam-boilers that a seamless shell might take the place of the aggregation of plates held together by riveted joints which now constitutes the ordinary method of constructing a boiler. A recent construction in this country is an internally fired boiler of large dimensions, 8½ feet diameter by 27 feet long, having welded horizontal and vertical seams, but with heads riveted in. Such examples are rare, but they serve to show what is possible by this method of construction if proper facilities are at command, coupled with knowledge of how to successfully use the facilities towards the desired end.

Wrought-iron and mild steel possesses the property of welding when brought into perfect contact while the surfaces are in a state of partial fusion. To further insure a complete contact, the surfaces thus joined are pressed, rolled, or hammered until they are united in a single piece at the weld. Small quantities of the impurities usually found in wrought-iron, such as sulphur, phosphorus, etc., exert a marked influence upon the properties of wrought-iron. These foreign substances do not wholly prevent the welding of wrought-iron when parts are brought together in a state of fusion, but they do have the effect of lowering the efficiency of the welded joint, especially when the heating and welding are undertaken in an atmosphere containing free oxygen. In a non-oxidizing atmosphere these influences are less marked. What has just been said in regard to wrought-iron is also true of mild steel, which does not readily weld except in a non-oxidizing atmosphere. After many trials and many failures in attempting to weld mild steel boiler-plates, Adamson found it necessary to ascertain in all cases the composition of the metal before putting any labor on it, and, from a large experience, he considered it desirable that the carbon should not exceed ⅛ of 1 per cent., while the sulphur and phosphorus should, if possible, be kept as low as 0.04 per cent., silicon being admissible to the extent of 0.1 of 1 per cent.

A high temperature is essential in welding, approximately 1600° Fahr. for wrought-iron; but different irons require a temperature adapted to each varying composition, because with such variation in composition, there is also a variation point of fusion. Temperature alone is not sufficient for securing the best results. It is true that a high temperature promotes welding in a non-oxidizing atmosphere, but it is also true that in an atmosphere in which there is free oxygen, the latter, being the cause of burning the metal, not only prevents welding, but destroys the strength of the metal wherever it may occur. The temperature, then, must be regulated if welding is to be done in an oxidizing atmosphere, so as to insure the fusion of the metal surfaces to be joined and avoid covering such surfaces with a coating of iron oxide, which will either imperfectly weld or wholly prevent metallic contact.

The presence of oxide of iron in a joint is one of the principal causes of non-welding. It is difficult to prepare iron plates for welding without the presence of this objectionable material, and it is for this reason that upset scarfed edges should have a swell in the middle of the angular face, as shown in Fig. 1, the object being to bring the metal into immediate contact at the middle of the weld, so that any subsequent hammering will force out the vitreous oxide on either side, securing a better weld than if it were allowed to lodge on either surface of the plates, for any lodgment would mean defective welding at that point.

An oxidation always occurs in a greater or less degree, the heated surfaces must be protected by means of a flux. The one generally used is sand; this is composed of silicon and oxygen. The action of the flux is two-fold—in forming a vitreous coating over the iron, and in reducing the temperature of the parts to which it is applied. This arises from the circumstance that iron is usually "scarfed" at the place where

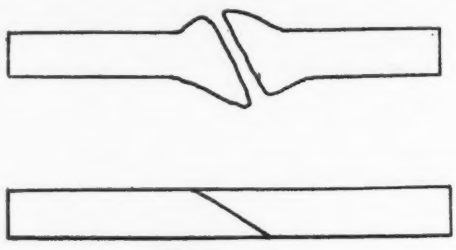


Fig. 1

it is to be welded, as in Fig. 1. We thus have a thick and a thinner portion of the same plate exposed to the action of heat. Ordinarily the thinner portion of the plate is nearest the centre of the fire, consequently it attains welding heat before the thicker portion does. If the action of the heat was not modified in some manner, this thinner edge would be burned away long before the thicker portion was brought to the welding point. The sand on the other flux coming in contact with the highly heated iron, is melted, and absorbs so much heat from the iron that it gives the latter a vitreous coating, combining with the iron and covering that portion

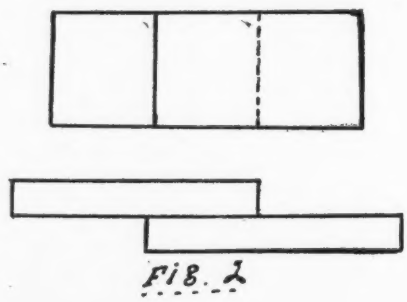


Fig. 2

which is of sufficiently high temperature to melt the sand. Silicon, being very refractory in its nature, will last some time in the fire before it burns off the iron; it thus serves to protect the thinner parts of the iron, while the thicker portion is absorbing heat and arriving at welding condition. In using sand as a flux, care must be exercised that it be cleaned off the faces of the joint where two scarfed edges are to be welded, because its presence in the weld would prevent perfect contact and weaken the joint. For small work, borax is the flux generally employed in the forge for welding; it prevents oxidation in the same manner as already described for sand.

Scarf-welding, shown in Fig. 1, is to be preferred to lap-welding, Fig. 2, because the strain on the scarf-joint is direct, while on the lap-joint it is indirect and tends to distort the joint when under pressure, as in Fig. 3. A scarf-weld is best

made by upsetting the edges to about double the thickness of the plate and bevelling the edges to about 45°, as shown in Fig. 1. In scarfing and thinning down the plate, the sharp edge may be about one-sixteenth of an inch thick, perhaps less. An exact thickness of the upset portion is not a material part of making a good joint, neither is the thinning to a sharp edge of special importance. All that is necessary is the upsetting of the edge to a thickness considerably more than that of the plate itself, the object being that when the weld is made, the plate may then be hammered and finished down to the regular thickness. The edges should be heated simultaneously to a white heat, and, when joined, the joint should be hammered or rolled to secure perfect contact through its whole length; the swell of the joint can be afterwards worked down to the thickness of the plate. This is a much better method than that shown in Fig. 2.

Lap-welded joints, as shown in Fig. 2, are not recommended, except for thin plates, say ¼ inch and less, because they are weaker than scarf-welded, although there is no reduction of plate section through the joint. This has already been pointed out and illustrated in Fig. 89. The thicker the plates joined together, the greater will be the distortion in the joint. This fact was clearly brought out in the following test, which shows the ½ inch joint to be relatively weaker than the ⅜ inch joint in the same test.

If a weld is to be made in a brace or stay, the ends should be upset to about double the original diameter, afterwards bevelling to an angle of about 45°, as in Fig. 89. This form of joint is favorable to the escape of scale, flux, etc., out of the joint. After the parts are joined, the swelled portion of the joint can then be hammered down to the common diameter or size of the bar. Wherever possible, stays and braces should be made without welds.

The heating of the two plates in a well-made open fire is attended with greater risks than in the case of the two bars of iron. The reasons are quite obvious: The ends of the bars are easily placed in the centre of the fire and entirely shut off from the injurious effects of free oxygen, if the fire is properly made. When a thick fire is built upon a tweer, the air passing up through it gives up its oxygen to the incandescent carbon, and carbonic acid gas is the product of this union. This gas, in passing up through the bed of burning coal, takes up another equivalent of carbon, and carbonic oxide gas is formed. Nitrogen is also present in the fire. But none of these gases have an injurious effect on iron, so far as welding is concerned. Therefore, the two bars of iron referred to above are in a highly heated chamber, formed by the incandescent sides and cover of the fire. The included atmosphere being non-oxidizing, the bars may be readily brought to a welding-heat without fear of oxidation, for there is no excess of oxygen in the fire to come in contact with the iron. In the case of plates, it is somewhat different, for the plates being hottest in the centre, and of lower temperature towards the edges of the fire, it is not possible to confine the heated portion of the plates to a chamber of heated gases from which oxygen is excluded—for no such chamber exists in an ordinary fire, and cannot from the nature of the case. Further, every movement of the plate brings the more or less highly heated portions in contact with the air; oxidation instantly occurs, forming an oxide of iron or hard cinder, which prevents welding. There is, at the same time, a partial loss of iron; but this is not a serious matter in comparison with the bad effects resulting from the presence of oxide of iron in the weld.

In the manufacture of welded boilers as a business, it would be necessary to construct a special heating apparatus, which would probably consist of an external and internal gas-furnace, operating on the principle of a blow-pipe, in which the flames of the burning gas would be directed against such portions of the joint as needed the greater heat. Such an apparatus could be made in which no free oxygen could reach the heated plates, and thus welds could be made without the use of a flux of any kind. The plates could be heated their whole length at one time, and when brought to the point of fusion, could be welded by pressure instead of by hammering.

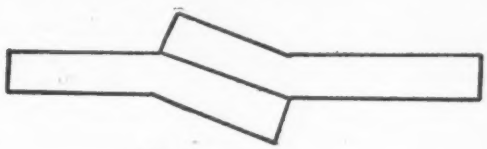


Fig. 3

Welding occurs only at the edges or ends of parts to be thus joined. Heating, therefore, should be confined to such portions only, and not allowed to extend over wide areas upon which no work is to be done. In the absence of special appliances, no greater length of edge should be heated than can be conveniently and properly welded, because excessive temperatures occurring where no work is to be done, especially if in contact with the air, is fatal both to iron and steel plates. Without special heating appliances, it is probable that not more than a few inches—say less than a foot—could be heated at any one time; and this heating might preferably begin at the centre of the length of the joint and work from there to either end, rather than begin welding at one end and work towards the other. Whichever method be adopted, there are likely to be strains set up in the plates thus joined, both in extension and compression, which can only be eliminated by proper annealing.

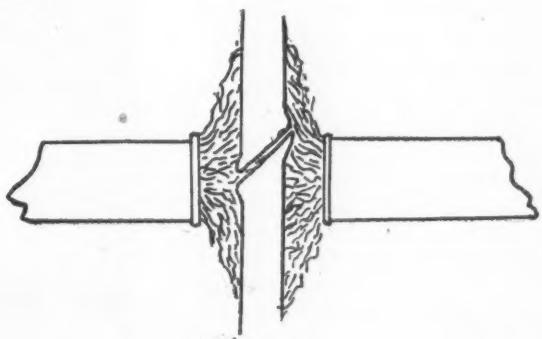


Fig. 4

By Betram's method, boiler-plates were welded at the Woolwich Dockyard in 1857. The edges were scarfed and placed together between two flames directed against either side, as shown in Fig. 4. These flames were obtained by the combustion of coal or coke, and were non-oxidizing in their character. When the two plates were raised to the welding temperature, they were united by pressure or hammering in a special machine.

Tests made of these welded joints showed that the lap-welded test-pieces, as in Fig. 2, were inferior in strength to those scarf-welded, as in Fig. 1.

The specimens tested were 4 inches wide by ⅜, 7/16 and ½ inch thickness. The lap of the joint was 1¼ inches, with results as follows:

The strength of a scarf-welded joint, Fig. 89, for the ½ inch plate was faulty; but for the $\frac{7}{16}$ and ⅜ inch plates, the welds were equal to that of the original plate.

The strength of the lap-welded joint, Fig. 90, was for the ½ inch plate, 50 per cent. of the original plate, increasing to 69 per cent. in the $\frac{7}{16}$ inch plate, and 66 per cent. in the ⅜ inch plate.

From the above data it appears that the strength of joints united by lap-welding is scarcely greater than that secured by single riveting, the joint being about 40 per cent. weaker than the plates which compose it. Scarf-welding, on the contrary, equalled the strength of the plate. No doubt, the shape of the joint under severe stress had much to do with the lowering of its strength in consequence of the indirect pull, as shown in Fig. 3.

It would be advantageous if, in the case of plate work, the whole structure, after welding, could be placed in an annealing furnace, properly heated, and allowed to cool gradually; but this is not always practicable. In lieu of this, a strip wide enough to cover any excessive heating on either side of the welded joint, should be heated to a cherry-red and then allowed to cool gradually.

✣ ✣ ✣

A Difficult Job

Old Machinery Made New

It often becomes necessary to remove, to enlarge, or to increase the machinery in a plant, and in some cases to transfer to other places a part, or all, the old machinery in moving to newer buildings, etc. In this way oftentimes hundreds of dollars worth of valuable material is consigned to the scrap heap simply because the superintendent could see no practical way of utilizing the material under the new conditions. Therein a great mistake is often made, what was improbable and impossible a few years ago is to-day, under the hands of the mechanic skilled in such work but a question of opportunity, to enable him to succeed in placing seemingly worthless scrap on a par with the newest pieces of machinery in the shop. Hence, it is always well when making changes to consult some one who is familiar with making such changes. The added expense will be nothing compared to the saving obtained by the expert in his line.

The accompanying illustration shows an instance where the forethought of calling in a skilled mechanic to remove old machinery effected a saving of several hundred dollars.

About twelve years ago The American Cement Company erected a plant at Jarden, N. Y., installing a 24″ by 48″ Corliss engine; the engine supplied power to two line shafts by the use of two thirty-six inch double belts. One run from the engine, and the other run back by the valve gearing. The two wheels measured respectively 37½″ by 15′, and 37½″ by 15′ ⅜″—one having a ⅜″larger diameter than the other.

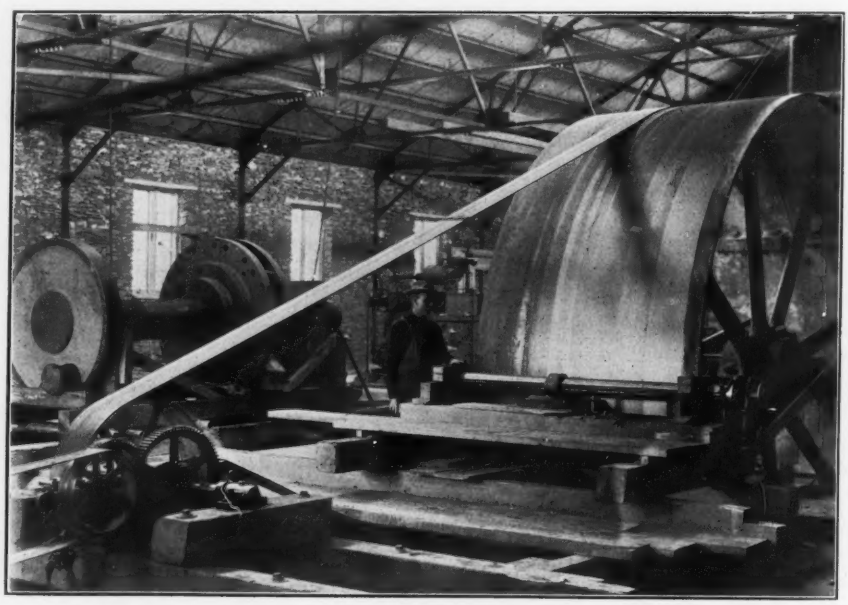
This machinery was used for about nine years, but during the last three years the factory has been abandoned. Lately the Company have erected a factory at Egypt, Pa., and the engine from the old factory was to be moved there. The idea of using the two large pulleys was abandoned, as they would have to be used in the new mill side by side, and, being of different diameters, it seemed impossible. Hence they were consigned to the old iron pile.

To make the required change of machinery John T. Lindstrom, Allentown, Pa., was called in. To his practiced eye the adoption of the two condemned wheels to the new use became at once feasible. The engine itself was taken down and transported from the Jarden plant to the new place at Egypt in the short space of twelve days; after erecting the engine, came the work of placing the two wheels on the same shaft so that they would set properly and draw alike. How this was effected, a study of the cut will show.

The first work was to get the wheels placed upon the shaft and securely fastened; this was done by the use of four plates, 9″ by 3″ by 1″, having two 1¼″ holes drilled 6 inches apart; bolts made to fit were securely screwed through these to the rim of the wheel, thus insuring their rigidity. This done, the arrangement for turning off the face of the wheels was made; a few, ten by ten, timbers were bolted together in crib form, and across the top of this was placed an ordinary boring bar which was securely adjusted in two hard wood boxes, at a perfect square with the engine shaft, and then properly levelled. The feed-gear was then attached to one end of the bar, with the feed-motor taken from the eccentric of the engine, thus securing an automatic feed.

At a distance of 20′ back from the bar a triplet of gears and a 36″ pulley was rigged; from this pulley was run a 10″ belt around the wheels to be faced off. Power was supplied to the triplet gearing from a 4″ belt run back to a five horse-power engine.

After this arrangement was perfected nothing remained to do but set the tool and start the wheel revolving, which was done at the rate of 42 feet per minute.



FACING OFF A LARGE WHEEL.

After the ⅜″ was taken off the larger wheel, a cut was taken across the whole face of the two wheels, 6′ 3″. After finishing that cut, the taper on crown was then easily turned. The surface was left for a distance of 18″ in the centre perfectly flat; from that point the crowning was carried to the

edges, thus completing the job and making the wheels answer the purpose in a manner equal to a new one at a cost not very much in excess of the freight rates and cartage of a new one. In the background of the photograph can be seen a 32" by 48" engine under process of erection. The shaft can be seen upon skids preparatory to being placed in position.

Hence the moral, "that which one has, the other hasn't, not to all alike is this world's goods apportioned," would be well applied in cases where changes are contemplated. Because you or your superintendent regards a thing as useless, is no criterion upon its real value; always give credit where credit is due, and remember that the uses of the world demands the adoption of many professions.

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A Lesson on Boiler Setting

Employers as a rule, when they anticipate the purchase of a new boiler, expect the engineer not only to be in possession of the proper knowledge of that which is directly analogous to his profession, namely—the design, quality, etc., of the boiler to be accepted, but he is also expected to be able to figure the cost of setting, the material to be used, and many times is to be able to draw up the proper plans and specifications for the work to be done. In fact this is true of the advent of any added improvement to the machinery department which the engineer may be compelled to ask for.

Of course, there are exceptions to this rule, but the reader of this article will agree with me that the exceptions are rare indeed.

In writing this article it is the intention to, as nearly as possible, place the engineer in possession of the proper knowledge of the methods used in the construction of the average boiler setting; of the material used in the work and such other "tips" as will be valuable in accomplishing such a job.

In setting a horizontal tubular boiler never use any but the hardest brick obtainable; they having already been subjected to such a heat that they are not liable to disintegrate under the heat from the furnace fire. Always reckon on the first quality of fire brick for the furnaces; lay the hard brick in lime and the fire brick in fire clay mortar.

In placing the boiler in position it should set on an incline to be one inch to the ten feet in length of the boiler; this is to incline all sedimentary collections to the rear or cooler end of boiler, thus preventing such matter from precipitation upon the plates immediately over the fire.

The forward lugs of the horizontal boiler should rest directly on lug plates placed on the walls, and the rear lugs on expansion rollers placed cross-wise between the lug and the plate. Pockets must be built around all but the front lugs so that the boiler will have absolute freedom of motion during the action of expansion and contraction, otherwise the walls will crack.

From the top of the bridge wall to the under side of the boiler the distance should be six inches, in boilers up to three and one-half feet in diameter, and eight inches in boilers that are larger. The curve of this inverted arch of bridge wall should be drawn with a radius equal to the diameter of the boiler to be set.

For ordinary jobs only the furnace bridge walls and the rear walls, upon which the fire directly impinges, are lined with fire brick. However, all strictly first-class jobs should be lined with the fire brick the entire length of the flue and from the under side of the lugs to the grate bars as well.

In many cases the conditions are such that a flue will have to be returned over the top of the boiler; of course fire brick are not necessary there, a flat arch of brick can be sprung from the side walls, in which case heavy brick stays and tie rods should be used, as the arch has a tendency always to spread to the side walls.

It is, no doubt, a better plan to run up the side walls about twelve inches above the top of the boiler and cover the top straight across with wrought-iron plates about two feet wide of number 12 iron—these plates to be supported by 3½ or 4-inch wrought-iron T girders, and the whole covered over with two thicknesses of brick laid flat in loose sand.

This plan permits of easy access to the top of the boiler at any place, and at all times, and prevents the spreading of the side walls as well.

When the size of the boiler to be used, you can, by the aid of the following data, ascertain the number of bricks, etc., that may be required in the setting.

Let us take, for an example, a boiler three feet in diameter by twelve feet long, with a return flue over the top, set in twelve-inch walls. Allowing one foot front connection and two feet for back, would make the length of side walls sixteen feet over all, and eight feet high; hence 16x8=128 cubic feet, or 256 cubic feet for both side walls; rear wall 3¼ feet wide by 8 feet high equals 26 feet, or for both back and front walls 52 cubic feet. The bridge wall should be 3.25 feet wide, and an average of 3½ feet high x 1⅓ feet thick, or 15 cubic feet, making a total of 323 cubic feet. This multiplied by 21, the number of brick in a cubic foot, gives us a total of 6,783 brick, 5 per cent. of which should be fire brick for lining furnace, bridge wall and back connection wall. If full length of side walls are lined, allow 10 per cent. for fire brick.

The superficial area to cover the return flue on top is 16 feet long by 5¼ feet wide over all, equals 84 feet, 4½ bricks to the superficial foot when laid flat, equals 378 bricks, two thicknesses 756, floor of ask pit, 3¼ by 5, equals 16; 25 feet equal 73 brick, or a total of 7,612.

21 bricks, when laid up	1 cubic foot
14 bricks, when laid up	8-inch wall
7 bricks, when laid up	4-inch wall
4½ bricks, when laid flat	1 superficial foot.

For setting a thousand brick in lime mortar, 1 barrel of lime, 4 of sand.

For setting a thousand brick in cement, 1 barrel of cement, 2 of sand.

Rubble, 1 barrel of cement, 2 barrels sand, 3 barrels broken stone.

Height of chimneys, about 26 times their diameter.

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What Do You Think About It?

A bright young engineer who holds a responsible position, and whose opinion on things mechanical we value very highly, writes us as follows:

"Without the least intent to flatter you, I want to say that your July number of THE PRACTICAL ENGINEER was excellent from cover to cover. I do not believe that any engineer could get a bigger five cent's worth anywhere. That article on cylinder lubrication was worth the price of the entire paper.

The Practical Engineer.

PUBLISHED ON THE FIRST OF EACH MONTH
By L. L. RICE, 1213-15 Filbert Street, Philadelphia, Pa.

THE PRACTICAL ENGINEER WAS ENDORSED BY THE SUPREME COUNCIL OF THE UNITED STATES OF THE

American Order of Steam Engineers,

ON MAY, 13, 1897, AS ITS OFFICIAL ORGAN.

PUBLICATION COMMITTEE:

FRANKLIN R. MOORE, *Chairman.* J. C. McDOWELL, *Secretary,*
GEO. W. RICHARDSON, *Treasurer.*
FRED. W. MOORE. LOUIS WOODINGTON.

Address all Communications
and make all Checks, Money Orders and Drafts Payable to

THE PRACTICAL ENGINEER,
1213-15 Filbert Street - - Philadelphia, Pa.

SUBSCRIPTION RATES IN THE UNITED STATES, CANADA AND MEXICO FIFTY CENTS THE YEAR IN ADVANCE.

FOREIGN SUBSCRIPTIONS TO COUNTRIES WITHIN THE POSTAL UNION, POSTAGE PREPAID, ONE DOLLAR THE YEAR IN ADVANCE.

Entered at Philadelphia Post-office as Second-class Matter.

Supreme Chief Williams visited York Council, at York, Pa., during the past month.

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Columbia Council, of Columbia, Pa., has seven members residing at Elizabethtown, nineteen miles distant, with no direct connections by rail, yet the majority of them can be found at the meetings, at least once a month, either having ridden the distance on bicycles, or driven in carriages.

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Progress Council No. 13, of Reading, Pa., has been increasing its membership steadily since the Supreme Convention.

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We understand that a new Council of the A. O. S. E. has been organized at Coalgate, Indian Territory.

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Southwark Council has just received $1700.00 for matured shares in a building and loan society. They will get $2000.00 more in a short time.

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Welcome Council

Editor PRACTICAL ENGINEER:

The 18th of July, just past, marks an event long to be remembered by the members of Welcome Council. When First Assistant Grand Chief Engineer John Kelley arrived with his corps of assistants for the purpose of installing our new officers, he found the room well filled with members and their lady friends. At first Brother Kelley seemed bashful, but soon warmed up to the occasion and performed the duties of installing officer with becoming dignity and great credit to the Order. Following the installation ceremonies, we all adjourned to the banquet hall adjoining, where the ladies had prepared a feast fit for the gods, following which Brother Kelley distinguished himself by delivering an able address setting forth the beneficient advantages of our Order. Brother Pieling "did" a recitation, and Brothers Knoos, High and Goetz sang songs.

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Southwark Council

On Monday evening, July 7th, 1902, Grand First Assistant Engineer John Kelly, assisted by Grand Sr. M. M. Thos. Marshall, installed the newly elected officers of Southwark Council, No. 4, as follows:

Chief Engineer, Joseph Hynes; First Assistant Engineer, L. H. Covington; Treasurer, Wm. Small; Financial Secretary, F. R. Moore; Recording and Corresponding, J. G. McDowell; Chaplain, Joseph F. Wheaton; Sr. Master Mechanic, Wm. Harney; Jr. Master Mechanic, Rob't Cardwell; Inside Sentinel, Edw. Dickisson; Outside Sentinel, Wm. Conner; Trustee, Jas. K. Holland.

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New Officers of Philadelphia Council

Philadelphia Council, No. 7, which meets Wednesday evenings at Kenneys Hall, Broad and Filbert streets, elected the following officers at their regular meeting of June 25th:

Chief Engineer, Jas. J. Murphy: Assistant Engineer, Geo. R. Woolcock; Senior Master Mechanic, G. W. Richards; Junior Master Mechanic, Harry Dunn; Recording and Corresponding Engineer, W. S. Wetzler, 3707 Aspin St.; Financial Engineer, Peter Hardman; Treasurer, John M. Curry; Chaplain, Clarence Muncey; Inside Sentinel, Thos. B. Prescott; Outside Sentinel, John Lee; Trustee, W. J. Eccles.

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Pottstown Council

Supreme Chief Engineer Clifford P. Williams, assisted by Grand Recording Engineer Al. Keppleman and Grand Chief Engineer H. M. Trout, installed the following newly elected officers of Pottstown Council, No. 14, of Pottstown, Pa., on Saturday evening, July 19th:

Senior Past Chief Engineer, Jacob Crater; Junior Past Chief Engineer, Joseph Rhoads; Chief Engineer, Clayton Fink; First Assistant Engineer, Joseph Umstead; Recording and Corresponding Engineer, H. L. Shirey, 362 Cherry St.; Financial Engineer, Harry Zollers; Treasurer, Jas. Warmkessel; Chaplain, Toby Pierman; Senior Master Mechanic, William Rickert; Junior Master Mechanic, Chas. Quinter; Inside Sentinel, Walter Halery; Outside Sentinel, George Hoffman; Trustees, W. Rickert, J. Rhoads and Jacob Crater.

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Germantown Council

The following officers of Germantown Council, No. 22, were elected at the regular meeting of June 25th and installed July

2d by Supreme Chief Engineer Clifford P. Williams, assisted by Supreme Corresponding Engineer J. C. McDowell:

Chief Engineer, John P. Rickards; Assistant Engineer, Chas. Dettrey; Senior Master Mechanic, Leidy Souders; Junior Master Mechanic, Geo. T. Lee; Corresponding Engineer, Franklin Mac Indoe, 3529 Ainslie St., Falls of Schuylkill, Phila.; Recording Engineer, I. J. Rosboshil; Financial Engineer, Harry P. Fowden; Treasurer, John Albus; Chaplain, John Eccreson; Inside Sentinel, John Brayman; Outside Sentinel, Edward Reboul; Trustees, Wm. Doyle, John Jamison and W. S. Wood. Delegate to Grand Council, John P. Rickards. Alternate, John Eccreson.

This Council, though but recently instituted, has made marked progress, and bids fair to become one of the foremost Councils of the city—a fact which is very largely due to its excellent retinue of officers, not the least of whom is Chief Engineer Rickards, who has been an able and energetic worker from the beginning.

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Another New Council in Louisiana

A new Council of the American Order of Steam Engineers was instituted at Jennings, La., on Saturday evening, July 5th, with the following officers:

Chief Engineer, Daniel R. Jones; First Assistant Engineer, Albert Jones; Recording Engineer, Chas. Perry; Corresponding Engineer, R. E. Funk, Jennings, La.; Financial Engineer, J. B. Turner; Treasurer, Chas. Hucklebridge; Chaplain, Wm. Davie; Senior Master Mechanic, E. Perry; Junior Master Mechanic, Willard Davie; Inside Sentinel, Alvis Harris; Outside Sentinel, Chas. Wood; Trustees, D. Jones, A. Jones and Chas. Perry.

The installation ceremonies were conducted by Deputy Supreme Chief Engineer J. W. Angers, of New Ibera. The Council will be known as Jennings No. 2. Brother Dan R. Jones, who organized the Council and was elected chief, was one of the charter members at Bridgeton Council at Bridgeton, N. J.

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Lehigh Council

It is seldom that a city of thirty-five thousand inhabitants can boast of an engineer's organization composed of as many excellent engineers as are to be found in Lehigh Council No. 15, of Allentown, Pa. This Council, though just approaching the anniversary of its third year, has a membership of more than a hundred, and its accomplishments have been such as to win an enviable reputation in its home city and the admiration of the officers of the A. O. S. E.

We have just received a letter from the corresponding engineer stating that, despite the warm weather, the interest in the Council seems to increase rather than diminish, and the educational work never lags.

The new officers elected for the ensuing term are as follows:

Chief Engineer, Wm. R. Smith; First Assistant Engineer, John Durrin; Senior Master Mechanic, Henry C. Snyder; Junior Master Mechanic, John T. Lindstrohm; Recording Engineer, A. J. Strauss; Financial and Corresponding Engineer, A. P. Dreisbach, 128 Chew St.; Treasurer, John Burley; Chaplain, Chas. O. M. Baer; Inside Sentinel, Jessie Williams; Outside Sentinel, Edmund Brader; Trustee, H. Snyder.

Iron City Council

The newly elected officers of Iron City Council, No. 21, of Pittsburg, Pa., were installed Saturday evening, July 5th, and are as follows:

Chief Engineer, Phillip W. Sutton; First Assistant Engineer, F. A. Vantine; Senior Master Mechanic, John Major; Junior Master Mechanic, James J. Stewart; Recording Engineer, John McF. Easton; Corresponding Engineer, F. C. Rose, care of St. Paul's Orphan Asylum, Idlewild, Pa.; Financial Engineer, Martin Kane; Treasurer, M. J. O'Sullivan. Chaplain, E. L. Werts; Inside Sentinel, J. O. Cowger; Outside Sentinel, John Liptah.

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Columbia Council

Grand Chief Trout installed the following officers of Columbia Council, of Columbia, Pa., on Saturday evening, July 5th:

Chief Engineer, Ruben Beard; Assistant Egineern, Amos Simmons; Financial and Corresponding Engineer, W. J. Courtney, 804 Walnut St.; Treasurer, John J. Nolte; Senior Master Mechanic, John McLane; Junior Master Mechanic, Dan'l Eckman; Inside Sentinel, W. C. Hammell; Outside Sentinel, Wm. Raum; Chaplain, Henry Messer; Trustee, Ambrose Bartch.

Columbia Council is progressing rapidly and promises to make the up-State Councils hustle for first place.

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Sorrow in Lehigh Council

Following the death of the wife of Brother Wm. F. Woodring, of Allentown, Pa., the following resolutions were passed by Lehigh Council:

WHEREAS, It has pleased Almighty God, in His Infinite Wisdom, to remove from our midst the wife and companion of our Brother Wm. F. Woodring,

RESOLVED, That Lehigh Council No. 15, American Order of Steam Engineers, extend their sincere sympathy to the bereaved husband and his only son of their loss, and be it further

RESOLVED, That a copy of these resolutions be placed on the minutes of the Council, also a copy be sent the Editor PRACTICAL ENGINEER for publication.

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Camden Council's New Home

Camden Council No. 3, of Camden, N. J, has recently come to the front as one of the most progressive councils in the A. O. S. E., having increased their membership from less than a score to upwards of a hundred in the short space of a few months. They have now moved to new quarters at the S. E. corner of Second and Arch St., Camden, where they have the exclusive use of very handsome rooms. Each member is provided with a key, and is thereby enabled to spend as much of his leisure time as he cares to with the free use of the Counsel's library, models, etc., from which to increase his knowledge of his profession. The regular meetings of the Council are held Thursday evenings, as heretofore, visiting brothers are always welcome.

Our New Deputy Grand Chief for Western Pennsylvania

The subject of this sketch, Mr. A. D. Hamilton, has just recently been appointed Deputy Grand Chief of the American Order of Steam Engineers for Western Pennsylvania. He resides at 2025 Forbes Street, Pittsburg, Pa., and is a member of Iron City Council No. 21 of that city, which Council he assisted largely in organizing. Mr. Hamilton is an engineer of more than ordinary ability and a rare good fellow with a host of devoted friends.

He was born in Pittsburg in 1849, educated in the public schools of that city, and, to use his own words, has been "pestering" around steam-engines continuously since he was 14 years old.

His first experience as an engineer was with the Pittsburg *Dispatch*, where he turned on steam to a pair of small slide

A. D. HAMILTON.

valve engines, about 8"x14", and fired an old cylinder boiler into which water was fed cold by city pressure. Later he obtained a position as fireman on the, then Pittsburg & Connellsville Railroad, and, before he was 21 years old, had been promoted to a running engineer. After several years' service with this road, he went west to accept a position on the Bingham Canyon & Camp Floyd Railroad, in Utah, resigning from there after two years' service to take a position with the Pine River Valley & Stevens Point Railroad, in Wisconsin. About this time an injury to his right eye impaired his usefulness as a locomotive engineer, and he returned to Pittsburg and took up steamboat engineering where, in a short time his ability and careful attention to duty was recognized and appreciated. Here also he was granted a chief engineer's license, which grade he still holds.

After following the Western rivers for several years, Mr. Hamilton became chief engineer of the Pittsburg Tube Works, where he remained from the time the plant was built until it was bought up by one of the trusts and closed down. He then erected engines for the Westinghouse Co. for two years. For the past three years he has successfully represented the Mohawk Refining Co., of Cleveland, O., manufacturers of the well known Mohawk Boiler Compound, high grade cylinder and engine oils, cup grease, etc., which Mr. Hamilton can tell you all about in a flow of beautiful language that never fails to inspire the well merited confidence of which he is so worthy.

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Progress Council, of Reading, Pa.

The recent Supreme Council meeting, at Reading, Pa., seems to have inspired the engineers of that city with new desires, and Progress Council is reaping a harvest in new members.

At the regular meeting on Saturday, July 5th, the newly elected officers were installed by Frank S. Miller, deputized for the work by Grand Chief Trout, who was unable to be present. Following are the names of the new officers:

Chief Engineer, Geo. W. Miller; Assistant Engineer, A. B. Hess; Recording and Corresponding Engineer, F. S. Miller, 3 Franklin St., West Reading; Financial Engineer, Geo. F. Moyer; Treasurer, Henry Fritz; Chaplain, Geo. Good; Senior Master Mechanic, Oliver Brunner; Junior Master Mechanic, Fred. Keterer; Inside Sentinel, John Killenberger; Outside Sentinel, Edward Jones; Trustee, O. A. Adams.

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Kensington Council

The new officers of Kensington Council, No. 3, are as follows:

Chief Engineer, David J. Ezrah; First Assistant Engineer, John C. Anson; Recording Engineer, Wm. B. Rowland; Financial Engineer, H. Myers; Corresponding Engineer, Chas. Fournier, 3115 Richmond Street; Treasurer, Chas. Cook; Senior Master Mechanic, Wm. H. Brackney; Junior Master Mechanic, John Crean; Chaplain, Frank Mellor; Inside Sentinel, Jas. McCartney; Outside Sentinel, George Wheatcroft; Librarian, Wm. S. Stott; Trustee for Eighteen Months, Geo. W. Kennedy.

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An Interesting Meeting of Municipal Council, P. F. D.

The regular monthly meeting of Municipal Council, P. F. D., No. 20, of Philadelphia, was held at their new quarters at Third and Brown Streets, on Thursday evening, July 10th, and their newly elected officers installed by Deputy Grand Chief John Kelly, are as follows:

Chief Engineer, Frederick Markoe; First Assistant Engineer, Daniel Bunting; Corresponding Engineer, Walter Myers, 1211 Howard St.; Financial Engineer, M. McCracken; Treasurer, Harry Hicks; Senior Master Mechanic, Wm. Orell; Chaplain, F. Hallman; Inside Sentinel, Passmore Collins; Outside Sentinel, Wm. Robertson; Trustee, Geo. Taylor.

An interesting feature of the meeting was a lecture by Chief Markoe on "Steam Fire Engines." Mr. Markoe has been a fire engineer for many years, during which time he has collected an amount of data and information concerning the construction and operation of this type of engines which is extremely valuable. He will continue a discussion of the subject at each succeeding meeting, and those who attend the meetings will undoubtedly be benefited thereby.

Work for You

[SECOND LETTER.]

To the individual member of the A. O. S. E.:

Referring to the pertinent question contained in the first of these open letters in relation to you taking a part in the educational work of the Order, I wish to submit to your careful consideration a few reasons why it would be of personal interest to you to devote a part of your time and energy toward encouraging that distinctive feature of the organization, so that the purpose outlined in its first object, "to promote a more thorough knowledge in its members of theoretical and practical steam engineering," may attain a larger measure of success than has heretofore crowned your efforts, and thus demonstrate that the promise implied in such declaration, which often acts as an incentive for engineers to affiliate with us and which in my opinion is the inducement that has brought to us the greatest percentage of our members, is not a mere empty bubble, but is a live proposition which is bound to benefit all who participate in a united effort to make our council rooms the powerful medium for the dissemination of knowledge that they are intended to be.

I desire it to be distinctly understood that I do not wish anything herein contained to be construed as an assertion or intimation that the educational work of our Order has not been successful, for such an assertion or intimation would be contrary to my personal experience and would also be contradictory to a statement I have made on more than one occasion, to the effect, that I do not believe that there is a member of our Order who has not been benefited by its educational features, and further, I do not believe that there is a member of our Order who has attended the meetings of his subordinate council, even to a limited degree, who is not a better engineer than he was when he first cast his fortunes with it. You may not realize or agree with this, but a close personal observation covering a period of nearly thirteen years of men and events in our Order, convinces me that this statement is absolutely true.

It is an unquestioned fact that the more adept a man is in applying his knowledge of a vocation, the more successful he is in his calling, consequently it is an almost universal rule that the greater the ability to apply knowledge, the greater is the remuneration commanded. As you are all striving for a better compensation for your services, it is necessary that you should avail yourself of every possible means of increasing your store of knowledge of steam engineering and your ability to apply it. In this connection, I recall a remark made to me a few years ago by a good engineer, one of those old-timers whose whole store of knowledge had been acquired by hard knocks, to the effect that "we are paid, not for what we know, but for what we can do." That brother engineer did not realize that he was paid for knowing how to run successfully the steam plant of which he had charge, and his success in doing so was dependent upon his ability to apply his knowledge to the peculiar conditions he came in contact with. I quote this little instance for the sole purpose of impressing upon you the fact that in order to be a successful engineer you must possess and be able to apply a thorough knowledge of the creation and application of steam-power.

What constitutes a successful engineer? This is a question which naturally interests you; is it always the man who has charge of a large power-station, or is it invariably the man who occupies the Chief Engineer's state-room aboard a great ocean greyhound? No! decidedly no! An engineer's success should not always be gauged by the figures which represents the amount of power he has under his supervision, but in justice it should be measured by the amount of ability and knowledge he applies to his work; the engineer who obtains the greatest efficiency out of his plant, irrespective of its size, is the successful engineer, and the engineer whose position as such is properly recognized and who has the confidence of his employer and whose opinions and suggestions are treated with due respect and courtesy, is the successful engineer.

The locomotive engine does not reach the proportions of some of the great units we find in large power-stations nor is it to be compared with the intricate machinery contained in the engine-room of a mammoth ocean steamship, but who will assert that the man behind the throttle who maintains so thoroughly a complete mastery of self and upon whose ability, care and watchfulness the safe transportation of precious lives and valuable merchandise depends, is not a successful engineer? There is room for educational work along this line.

My purpose in writing this is to arouse you to a realization of the truth of such assertions and to lead you to see that the council meetings of the American Order of Steam Engineers can be made a greater benefit to you in an educational way if you will only do your duty as an individual member by promoting discussion of engineering topics in the meetings and thereby secure for yourself, and the members of the Order in general, that great benefit which must come to you as a result of an earnest effort to improve the efficiency of the educational work of the organization.

I realize that this invocation would not produce any permanent gain if it should go no further than only an appeal for a more earnest effort for the good of the Order, and as such it may or may not create a spasmodic enthusiasm which would soon die out. That is not what is needed; what is required is that either the present efforts of the Educational Committee should be made more effective by being universally supported, or that an entirely new plan should be devised to interest every member in the work in such a manner as to make the labor pleasant, profitable and permanent.

I would, therefore, invite you to write immediately to me giving expression to your criticism, opinions and suggestions in relation to the question thus presented before you, so that the Educational Committee may have the benefit of such expressions in determining the best method to procure the desired result. You will notice that I ask you to write immediately; I certainly wish you would do so because the postponing of such a good intention until to-morrow may result in a defeat of its purpose. I would also ask you to call your brother members' attention to this request.

In the educational field of our Order there is *work for you.*

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The PRACTICAL ENGINEER, as our official journal, has added materially to the extension and progress of our Order and because of this it is entitled to unstinted encouragement on your part. The efforts that Mr. Rice has put forth in the past toward making the publication as interesting to you as possible, as well as the valuable services he has rendered the organization by the energy he has devoted toward the formation of new councils and the upbuilding of the society as a whole, not only merits your approval but should also receive at your hands that mutual co-operation and aid which the nature of the work he has undertaken demands. It is not sufficient that you should say to one another, yes! The PRAC-

TICAL ENGINEER, under the direction of Mr. Rice, is doing good work for our Order, but you should go further and do everything you can to render that work effective

There is no necessity for me to go into details here, as to the advisability of supporting the official journal to the best of your ability. You all realize it, but the point is to persuade you to do it. The fact that you recognize the value of the publication amounts to nothing if you do nothing to add to that value. Perhaps you have a grievance; forget it if it interferes with your duty; there is no question that in the publication and distribution of an official journal mistakes will occur and errors of judgment will creep in; do not, because of this, become antagonistic, but rather remember that we are all human and consequently liable to err. If you do thus, remember, it will help you to obtain a greater forbearance when you need it (that *you* includes the writer).

In concluding this part for the time being I would submit a few questions and comments thereon to your careful consideration. Is your name on the subscription list? If it is not, it should be; there is no excuse for its absence; the price is within your reach. If you are a subscriber, do you try to induce your brother members to subscribe? An effort in this direction would be a great help. Do you read it every month and see in its columns something of what is being done to further the interests of our Order and also your interests as a member thereof? Do you contribute anything to its columns to make it interesting to your fellow engineers? The column headed, "Letters from Engineers," and the pages devoted to society notes would be improved by your contribution. When you are in need of anything for your plant, do you consult its advertising columns? And in writing to its advertisers for information, do you mention the publication? And thus help to retain advertisements upon its pages. Every advertiser is looking for results and it is up to you to produce the results.

Trusting that it will not be long before you will all be able to answer these questions in the affirmative, I am

Fraternally yours,
CLIFFORD P. WILLIAMS,
Supreme Chief Engineer A. O. S. E.

LETTERS FROM ENGINEERS

In order to make this department of THE PRACTICAL ENGINEER as interesting as possible, a moderate rate will be paid by us for all contributions published under this heading. However, we do not assume responsibility for the ideas or opinions expressed. None need hesitate to contribute because of inability to draw or write well. We will redraw or revise whenever necessary—it is the idea we want. New ways of doing old things, criticisms of accepted theories and general engine room experiences are especially solicited.

Marine Engineering on the River Elbe

Editor PRACTICAL ENGINEER:

I take pleasure in sending you a description of marine engineering as adopted on the river Elbe. The method is so unique and un-American that I feel sure it will be of interest to the many readers of THE PRACTICAL ENGINEER,

The navigation of the river Elbe is no small undertaking because of the swiftness of the current and the narrowness of the stream.

In order to overcome these difficulties the use of a chain for propelling steamers has been adopted with great success. The system is as follows:

A chain lies in the channel of the river from Melnick, a point in Bohemia, to Magdeburg, a distance of some 290 miles. At one time the chain extended to Hamburg, but as the country is flat and the current of the river sluggish below Magdeburg, its use between that city and Hamburg was abandoned in 1898.

The boats are of symmetrical structure, and by reversing the engines, move up or down stream without turning. They are provided with rudders at either end, operated independently by a pilot wheel located in the centre of the boat.

The course of the steamer is not seriously influenced by the chain, and it usually obeys the helm as if it were free. The hull and sides are made of iron, and to meet the rise and fall of the chain, the deck slopes on an incline of about a yard from the centre toward each end.

The vessels are provided at each end with deliverers or outriggers, which swing in a semi-circle around a pivot by means of rollers on rails, and serve to take up the chain out of the water at the bow of the boat and drop it at the stern. The chain runs over the forward outrigger and over several roller disks until it reaches a steam drum (or drums) located in the centre of the boat, which it encircles three times. It is then carried aft over another set of rollers until it drops into the water.

By means of an intersposed interchangeable gear the velocity of rotation is altered according to the course of the vessel up or down stream.

As there is only one chain for the up and down travel, the vessels have to leave the chain when passing each other. In such a case the steamer going down stream stops, locates a lock-link and opens it at the down-stream end. To either end of the thus parted chain, ropes are fastened and the vessel slowly moves down stream until the rope fastened to the up-stream end of the chain reaches the drum. Then the rope is removed and an auxiliary chain put in its place, which is wound upon the drum—the vessel still proceeding down stream—until the chain reaches the outrigger at the bow. At the same time the down-stream end of the chain has been dropped by means of the attached rope into the water, and consequently will be found near the stern outrigger, where it is taken up and connected again with the forward chain end, after the auxiliary chain has been removed by replacing the lock-link. Before the connected chain is dropped again into the water the steamer anchors itself by means of a small auxiliary chain to the main chain, to prevent its drifting down the river. A signal is now given to the up-stream vessel, informing it that everything is ready, and it advances until both vessels are side by side. Both vessels are now tied together, and the down vessel is taken up stream a short distance in order to free the auxiliary chain from the main chain. The up-stream vessel slowly proceeds until the lock-link reaches the stern outrigger, where it is opened, the down-stream end is picked up and a thin rope attached to it. It is now taken over to the rear outrigger of the down vessel and there secured by means of a catch. This steamer now is allowed to drift until its forward outrigger comes alongside the stern outrigger of the up-going

vessel. The auxiliary chain of the down boat is now taken in through the rear outrigger of the up vessel, and is connected again to the front end of the main chain. The down vessel drifts the length of the loose chain that has accumulated in the rear chain box of the up-stream boat, and the latter can now proceed, the down-stream vessel following until at first the auxiliary chain and then the main chain have run over the drum. The auxiliary chain is now disconnected and the end of the main chain is drawn by means of the rope through the rear chain groove up to the rear outrigger, and there connected by the lock-link to the other main chain end.

The two steamers have now passed each other, and, both being on the main chain, can continue on their way. The whole operation takes between 15 and 30 minutes.

T. T. M.

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QUESTIONS AND ANSWERS.

THE editor will be glad to receive from the readers of THE PRACTICAL ENGINEER, such questions relating to engineering subjects, as may, from time to time, occur to them. All questions and answers should be addressed to the editor and accompanied by the name and address of the writer, which will not be published, however, unless especially desired. It is the intention that questions shall be answered by the readers, and even though the editor may, from time to time, publish answers with questions, he especially desires the readers in such cases to contribute any further information in connection with the points raised, that they may consider of interest. All questions and answers received by the editor will be published, as far as practicable, but he reserves the right of editing or rejecting any communications.

Editor PRACTICAL ENGINEER:

As I have been much interested in your "Question and Answer" columns, I will just call your attention to the error in the May issue pertaining to the oil tank by J. Luther. The manner in which you figure the volume of the tank is incorrect, then again in the July issue we have a rough estimate by Louis Brodur which is far from being accurate. I am surprised that anyone should overlook the proper rule for finding the contents of a tank of these dimensions. This tank being 8′ 5″ diameter at bottom, 7′ 6″ diameter at top, 5′ 2″ high. The above would be called frustum of a cone.

The rule to find the volume of a frustum of a cone, which can be found in any common arithmetic, is as follows:

Add together the area of upper and lower base and the square root of the product of the two areas. Multiply the sum by one-third the altitude.

Diam. 8′ 5″=101″
Diam. 7′ 6″= 90″
Height 5′ 2″= 62″

Area=101^2 x .7854=8056.8+
Area= 90^2 x .7854=6361.7+

Thus we have

8056.8+6361.7+ 8056.8x6361.7=
14418.5+ 51255712.15=

14418.5+7159.3=21577.9

Then we multiply the result by one-third the altitude:

$$\frac{21577.9 \times 60}{231} = 445943.373$$

$$\frac{445943.373}{231} = 1930.5 \text{ gal.}$$

A READER.

Editor PRACTICAL ENGINEER:

Will you kindly give me, in your next issue, an illustration of the Seven Wire System including ground wire and connection?

Also decide this question for me:—I, as A, claim that water in a boiler making steam does not touch the shell at the points where it is sufficiently hot to create steam. B says it must come in contact with the shell, otherwise the shell would become overheated?

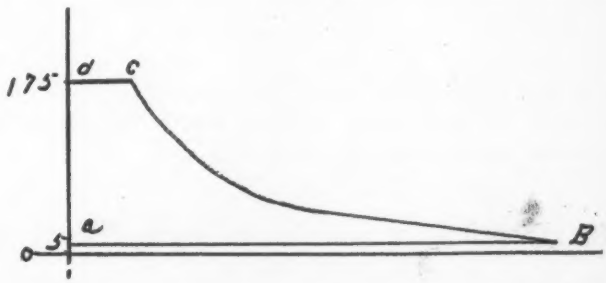
In reference to question of J. B. Hughes, which is similar to a question I asked you about a year ago, I am not yet satisfied. Is it not a fact that, as per card, the three inches of stroke carries the 35.185 pounds against the compressor piston continuously, and at no time does the engine reach that number of pounds pressure? I have been told that it is stored in the fly-wheel; but, as has been the case, I have shut down the engine and started up again, neglecting to shut expansion valve when starting. There can be no stored power then, can there?

J. C. W.

Concerning the seven wire system, so far as we know, there is no universal system of the kind, hence you would have to give us a clearer conception of your meaning before we can answer this question.

In answering the question concerning the absorption of heat from the boiler shell, you will see that B is correct. In the absorption of heat, during the steaming process, water extracts through the shell enough heat units to create a globule of steam. The moment this is created, the globule must of necessity ascend to the surface, hence the moment it becomes of sufficient lightness to leave the shell, it does not stay suspended immediately over that portion of the shell, but rushes to the surface to make room for the heavier or colder body of water surrounding it, or, in other words, it starts a circulation which will continue so long as the heat supply is continued. In this way it becomes obvious that there can be no vacuum because the weight of the surrounding body of water, plus the energy of circulation, is constantly pressing aside the steam globule dislodging it before it can attain a size sufficient to create a vacuum. If this were not true, there would be no circulation.

Your understanding of answer to the question asked by J. B. Hughes in the June number of The PRACTICAL ENGINEER is at fault. If you will study the diagram and the answer,



you will find that the pressure on the compressor piston is not continuously 35.185 pounds, but that it only attains this pressure after the piston has traveled on the downward stroke from A. to B. and then on the return stroke to C., thus making almost a full revolution before forcing the pressure to 175 pounds, as shown on the card, and that pressure only exists during less than quarter of the return stroke. Hence, if you

will take the time, average up the card, you will find that we have, as stated in the June number, 60 pounds per square inch steam pressure acting on a piston of 18 inches in diameter, to overcome an ammonia pressure of 50 pounds (the average as shown by the card) per square inch on a piston 16 inches in diameter.—Editor.

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Editor PRACTICAL ENGINEER:

I have been reading the questions and answers appearing in the columns of The PRACTICAL ENGINEER and find the greatest satisfaction in doing so. I would appreciate an answer to the following question:

How much gasoline will it require to run a 60 horse-power gasoline engine 10 hours a day?

In explanation of this question I will say that my employer, through increase in business, is compelled to add more power to his plant. Through lack of floor space it would be more desirable to use a gasoline engine. It is to get a comparative estimate upon fuel consumption of both steam and gas engines that I ask the question. T. C. ZIMMERMAN.

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The average gasoline consumption for gas engines is roughly placed at one pint per horse-power per hour. In engines rating as high as sixty horse-power, however, this may be shaved a little, but not a great deal. There are many different makes of gasoline engines, and, of course, many different claims of economy in fuel consumption. No doubt there is a difference in them, but the above estimate is usually considered the proper average.—Editor.

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Editor PRACTICAL ENGINEER:

Will ammonia injure brass, babbit, or any kind of a bearing that heats? How would it do to use it on a high-speed engine that constantly heats? What effect would it have on a dynamo, and should it be used? B. C. HOUSE.

✣

It would be well for you to determine exactly the cause of the heating of your bearings, which may occur from various causes, namely—being out of line, possibly through lack of metal in the journals, or roughness in the metal. Ammonia is used for smoothing up the bearings in cases of the latter trouble, but it is not considered a very effective remedy, the action being very slow. The most powerful antidote for this trouble is mercury and nitric acid, which usually effects a cure where such a thing is possible. However, the action of these chemicals is so strong that the greatest care must be used in their application and should only be used by those familiar with their action. The corrosive action of ammonia precludes its use in any way around dynamos, it being injurious to the brushing surfaces.—Editor.

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The Dispelling of a Delusion in the Taking of Indicator Diagrams

Taking an indicator diagram from an engine, is in the eyes of many engineers, something so high up among the classics of the profession that the thought of having to take a card would throw them into a fit of nervous prostration. Yet, the taking of a diagram is such a simple matter that anyone can accomplish the task with ease and accuracy, if the proper care is taken in doing so.

Almost all engines now-a-days are provided with the proper valves for attaching an indicator; and no engineer should run an engine without having a knowledge of how the valves are set, etc., thus enabling him to obtain the proper results from his engine.

The days are fast passing away when to be an engineer only requires a knowledge of what valves to turn in order to either start or stop an engine.

To those fearful of making an attempt at taking cards, the following description will tend to allay such fears and inspire the novice with the proper confidence in so doing.

In taking up the instrument be sure that the proper spring is contained therein, and the paper placed properly in the drum, connect the cord to whatever reducing motion you may have decided to use, then open the cock on the pipe communicating between the steam engine cylinder and the indicator piston, (this starts the pencil movement) until a few revolutions of the engine have been made, or until the instrument is heated to a temperature due to the steam present.

During this motion examine the pencil mechanism to see that it is moving freely, which may be ascertained by placing the finger directly against and over the top of the indicator piston rod, and by following its motion up and down; the presence of any grit between the indicator cylinder and its piston, can readily be detected. If such should be found to be the case it will be necessary to stop the motion of the indicator and remove the pencil mechanism with the piston and thoroughly clean and oil before again replacing the indicator. Again set the indicator in motion, and after a few revolutions of the engine have been made, swing the pencil until it comes in contact with the paper on the drum and hold it there during one complete revolution of the engine. Withdraw the pencil and close the indicator cock, and immediately return the pencil to the paper in order to trace the atmospheric line. This should always be done as soon as possible after tracing the card, so that it may be drawn under about the same conditions (as to temperature, etc.,) as when the card is taken. When the power is to be measured, it is a good plan to keep the pencil in contact with the paper during a number of revolutions of the engine; and in measuring the diagram, to take a line most nearly representing the average. Diagrams should always be taken from both ends of the cylinder where correct conclusions are expected.

Although a diagram from one end of the cylinder may prove satisfactory, it is not safe to infer that one from the opposite end will be equally so; but on the contrary there will often be found a great difference between diagrams taken from each end of the cylinder, owing to the varying conditions of pressure, etc., usually found in practice. Very often this difference results from improper or uneven valve setting, wherein the period of opening or closing the valve, and also the point of cut-off differ at each end in relation to the stroke of the engine, and may be partly due to rough and torturous steam passages.

Sometimes the load may suddenly change during the interval between the taking of the first and second diagram, causing a disparity between them that might prove misleading, in that, it would give the appearance similar to that of an uneven valve adjustment, consequently after a careful consideration from a number of diagrams, it becomes a requisite of the engineer to use his best judgment in deciding the cause and applying the remedy for any irregular or unusual appearance of the diagram. This information can only be derived from

a careful application of the indicator and a study of the diagrams.

Where two indicators are used and placed at each end of the cylinder, the diagrams (if desired) may readily be taken simultaneously; but in case of only one indicator at hand, it must be changed from one end of the cylinder to the other; in order to obtain diagrams from both, a matter requiring considerable time and trouble; therefore, it will be found most convenient in such cases to place the indicator in connection with a three-way cock at the middle of the cylinder, thereby admitting steam from each end, so that diagrams can be taken from either end of the cylinder, by simply turning the handle of the three-away cock to the required position. This arrangement greatly facilitates the labor, and it also enables the operator to produce diagrams from each end of the cylinder, upon the same sheet of paper, and in the shortest possible time; it being very essential that the second diagram be taken as quickly as possible after the first, in order that the condition of speed, load and pressure may remain more nearly alike during the time occupied for both tracings.

It is also more satisfactory to the engineer to take diagrams from both ends of the cylinder, upon the same paper as it enables him at once to make a discernable comparsion of the pressure exerted on the opposite sides of the piston, throughout one revolution of the engine. After all required adjustment, that become necessary have been made, and as satisfactory diagram obtained stop the motion of the drum and remove the paper therefrom. Make memorandum on the paper of as many of the facts, as may be required, such as the style of the engine, where located, the diameter of cylinder, length of stroke, diameter of piston rod, the number of revolutions per minute, which end of cylinder, the scale of the spring, the vacuum in the condenser, the boiler pressure, the day and hour of taking the diagram, and any other factors that may enter into, and become necessary for an accurate consideration and solution of the diagrams.

For convenience of writing the data, and also for filing away for future reference, the paper used upon the drum is usually in the form of printed blanks of suitable dimensions to fit the drum of the indicator, for which they are designed, and contain the heading of the different principal factors necessary for computing from the diagram, the horse-power water consumption, etc., of the engine. For very expert tests, these blanks may be printed in various forms. to suit any required data necessary.

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Worth Knowing

A 1200 horse-power gas driven blowing engine has been built in Belgium. The engine has two explosion cylinders, giving a two-stroke cycle. The gas is ignited by means of a spark coil, and the engine is started by a small electric motor. The blowing cylinder and the two gas cylinders are arranged tandem fashion, the blowing cylinder being in the rear of the other two.

The gas cylinders are each 51 inches in diameter, and 55 inch stroke. The diameter of the air cylinder is 72¾ inches. The engine runs at 80 revolutions per minute, and can supply 20,000 cubic feet of air, at atmospheric pressure, per minute. The air pressure can be varied through a range of pressure up to 45 lbs. absolute.

It is of the highest importance to keep the blow-off pipe free from sediment of any kind, as the pipe is liable to fill up and burn off, and the only way to keep it free is to open the blow cock often enough to keep everything flushed out.

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The use of a steam engine as a gas engine without the necessity of any material alterations in the steam plant equipment, must naturally lead the average engineer to wonder how such a thing might happen. Just that sort of change has been made in connection with some Texas gas well work near Big Hill, Matagorda County, the case being stated by the Houston *Chronicle* as follows:

"At 900 ft. the drillers struck a gas formation with pressure much stronger than any other well in the coast country. P. M. Lea, of Lea & Sons, Beaumont, who is drilling the well, has made a permanent gas well out of it, and is drilling another well entirely with the gas power it furnishes. So great is the pressure that he has piped the gas into the boiler as a settling tank to prevent getting grit in the engine, and then connects it directly with the engine and pumps, and runs the engine with direct pressure without steam or fire, and is now down 400 ft. with the third well with the gas power. The pressure is not all turned on, yet the boiler blows off all the time at 110 lbs.

"After the gas is used for power in the engine and pumps, the escape pipe has the appearance of pipes in an ice factory filled with ammonia. The ice freezes a quarter of an inch thick on the outside in contact with the atmosphere, and chunks of ice form on the inside from condensation of gas and blow out when they shut off the gas sufficiently to be pushed out."

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John B, Berryman, in the *Engineer*, gives the results of a large number of tests at the Crane Co., as follows:

Ordinary commercial pipe, 12-inch and smaller, appears to have an ultimate bursting strength in excess of 1,500 pounds per square inch, provided the weld is perfect. We have tested some lengths of 10-inch pipe taken at random out of stock to 2,300 pounds per square inch; 8-inch, 2,000 pounds; 12-inch, 1,500 pounds; 16⅜ inch thick, 800 pounds; 24⅜ inch thick, 600 pounds, all without rupture or apparent distortion. We have tested, from time to time, thousands of pieces of all sizes, 20-inch and smaller, under 800 pounds per square inch, so that as far as strength is concerned, there appears to be no reason why pipe, heavier than standard, should be used on power plant work. In plants where the feed-water is bad, it is economy to run the feed lines of extra strong pipe, and this has become quite a common practice, even where the water is comparatively good.

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A. J. Duffy, a Pittsburg engineer, has announced that the preliminaries have been arranged for the formation, in New York, of a $1,000,000 company, and in Boston of a $500,000 one to develop his system of ventilation. The inventor states, in regard to his system, that it is designed to take the place of ice in hotels, packing-houses and other large establishments. The operation of the device is rather simple, and consists of compressing large quantities of air, which is reduced to a temperature of less than 50 degrees in passing through a jacket with chemicals, the composition of which is at present secret.

The cold compressed air passes through another coil, also packed with chemicals, in which it is reduced to a temperature of 35 degrees, after which it passes to the ice and refrigerator boxes and to the pipes for ventilating.

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An Interesting Method of Automatic Boiler-Feeding

There is no question but that best economy of fuel and the longer life of a boiler is best obtained by maintaining a fixed water line at the lowest possible point compatibile with safety. If the water is too high, there is a great excess of heat units required to raise the amount of water to the required energy. Then again when the steam space is restricted, there is an immediate production of wet steam, often resulting in great damage to cylinders and packing.

The life of the boiler is also undoubtedly increased by avoiding the unequal expansion and contraction of the metal, due to the varying temperatures and pressures which take place when the water level is constantly changing. If the water is too low, it necessitates the sudden forcing in of an unusual quantity of water at a low temperature, which is one of the surest causes of explosions.

In these days the successful application of automatic devices and appliances is so generally recognized that no human hand can regulate and govern with the precision of the automatic machine.

Steam generation being costly, notwithstanding the most approved modern equipment in the way of smoke-consuming devices, high evaporative power-boilers, etc., it is essential to practice economy, and whether this economy has to do with a reduction in the quantity of steam used by the engine, or with a reduction in the cost of putting the water into the boiler for the production of steam, the result in dollars and cents is substantially the same.

Every owner of a power-plant, or engineer in charge of a plant, should be fully alive to the fact that an automatic boiler feed system is the ideal system to use.

When we say "automatic," we mean a system that will admit of regulating to supply a known quantity of water per hour, and continue to supply that quantity until a readjustment may provide a greater or lesser quantity. The average steam-power plant of the present day has its work so carefully adjusted that the engineer knows very near what quantity is needed per horse-power per hour, and in factories using their operating machinery constantly, or virtually so, there is very little variation as to the quantity of steam used for each working hour during the day, and if at times the load is increased materially, such times, also the maximum of power is known to the engineer in charge; therefore, there can be no specious argument against the employment of an automatic boiler feed system, on which the delivery can be increased or decreased at will, but which after such increase or decrease in capacity will continue to deliver water at the rate set for, so long as the supply of water continues.

Pumps fitted with automatic governors have been the most generally used appliances in this direction, which, while they serve the purpose, are nevertheless subject to certain objections. We speak now of a boiler-feed system designed to be automatic. Pumps to be started and stopped by hand are used everywhere, but that does not constitute an automatic boiler-feed. They require more or less constant looking after, expense for repairs, and certainly a large amount of steam in proportion to the work performed.

The fact determined that the automatic boiler-feed is a practical essential of the 20th century steam-plant in so far as its working is concerned, it remains to decide upon a reliable device and one that will produce results under varied conditions. The following description of the Bundy Boiler Feed Trap will be of interest to those interested in such devices.

It can be set up and arranged to operate under practically any of the conditions that apply in a steam-plant. Will take water from a closed heater under city or hydrostatic pressure. By means of a Duplex System, water is taken from an open heater using exhaust steam for heating the water by direct contact. The trap may be regulated to deliver the quantity of water required, according to conditions, by throttling down or opening wide the supply pipe between the trap and the boiler, and working the trap up to its full or only a part of its capacity.

On the question of economy: The makers claim that this trap, tested under actual working conditions, used less than one-half of 1 per cent. of steam for the quantity of water delivered, and this test was made on a large size trap with a receiving bowl of large cubical capacity. That these results show a very large percentage of saving, cannot be denied. The best type of pump will require for operating, when new, between 200 and 300 pounds of steam for each horse-power developed in work done, or from 3½ per cent. to 5 per cent. of the quantity of water handled. The trap is so designed that the only force necessary to discharge the water into the boiler, under any pressure, is that force exerted by the weight of a column of water vertically located, between the trap and the water line of the boiler. The quantity of steam used is only that quantity needed to fill the trap bowl or receiver during the period of discharge which is a matter of a few seconds, and a percentage of this steam is condensed and passes back into the boiler with the water from the trap. The steam is not used as an agent of force in discharging the trap, but merely to produce equal pressures on the boiler and the trap, thus making potent the force due to gravity for emptying the trap of its contents.

Directing attention to the cuts herewith presented: Figure 1 shows the trap A feeding a boiler from an overhead tank F, through pipe E and heater C. There is also a pipe B shown, which would correspond to a connection to city pressure, providing same is available, passing the water through the heater and into the trap. Pipe K, at the trap, is the discharge pipe leading to the boiler, which is provided with a suitable check and stop-valve. Pipe L is the live steam connection to the trap for pressure equalizing. The quantity of water that the trap will deliver is regulated by means of the hand-valve shown in Pipe K. Pipe H is the discharge from the vent or exhaust opening on the trap, which is closed while the trap is discharging and open while it is filling, in order to relieve the trap of air and steam remaining in the bowl, uncondensed after the trap has discharged.

Figure 2 shows a Duplex system of traps for feeding from the open heater C through pipe E to trap B. This trap must be placed below the heater in order to permit of the water flowing into it by gravity. The pipe F connects the trap with a live steam supply, which supply may be taken from any convenient source. When the receiving bowl has filled, trap discharges and live steam is admitted through F, and the

water in the trap is forced by this pressure through pipe D into trap A, which trap in turn, when full, discharges through pipe K into the boiler. J is a water relief valve set to open at some pressure less than the steam pressure supplied to trap B, column of water through D and is fitted with a check valve, also a relief or safety valve; a connection from this relief valve can be made back into the heater, so as to save the overflow. Pipes H and G are from the vent openings, and are

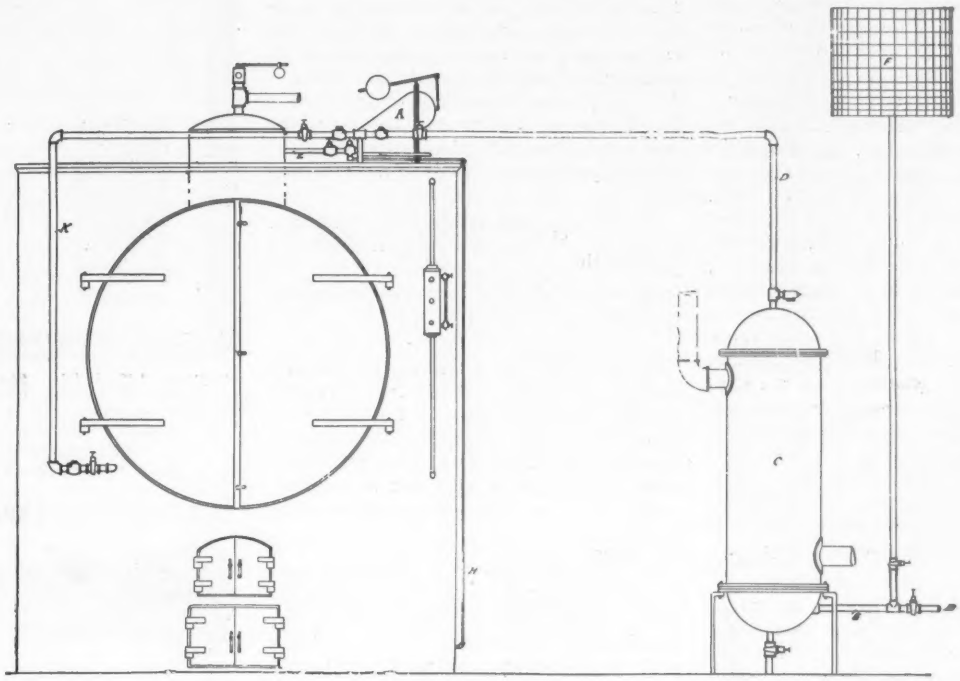


FIG. NO. 1.

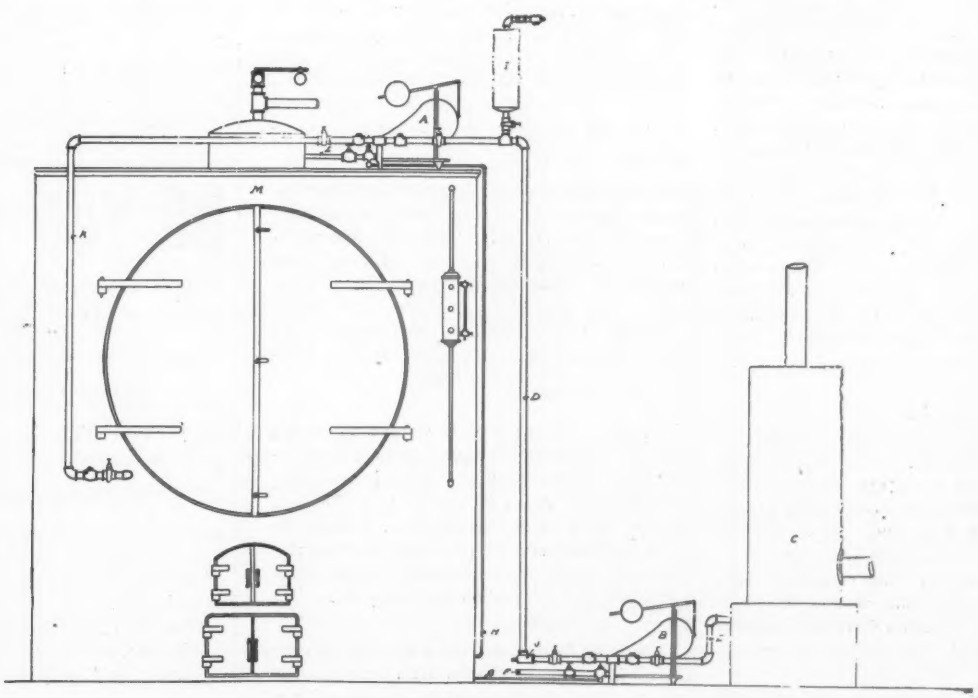


FIG. NO. 2.

and its office is to prevent the rise of the column of water in pipe D to a point corresponding to the water line in C and the consequent slow filling of the trap. I is an air chamber designed to take up the shock produced by a moving solid carried to a point underneath the ashpit. The range of work to be performed can be increased or decreased at will, within, of course, the necessary limitations covered by the trap's capacity.

TRADE NOTES

Jas. McCrea & Co. say that the warm months are not usually good for the sale of steam pipe clamps, but that the engineers know the Climax clamp so well that they are ordering in advance this summer in anticipation of future trouble.

The engineering department of the Pittsburgh Gage & Supply Co., Pittsburgh, Pa., has secured through Victor Beutner, engineer, Westinghouse Building, Pittsburgh, order for one 600 H. P. Brown Corliss Engine Co. (Corliss, Wis.), twin engines to drive direct connected electric generators at 136 R. P. M. in the new mill of the Susquehanna Iron & Steel Co., Lancaster, Pa. They have also secured orders for one complete White Star Filtering System for the new plant of the West Moreland Light & Power Co., Greensburg, Pa., of which James Bryan, Park Building, Pittsburgh, is the electrical engineer. Another notable order was from the Hoover, Owens & Rentschler Co., Hamilton, O., for supplying two cross compound engines of their manufacture with a White Star Filtering System. These engines are destined for the power plant of the Cincinnati, Georgetown & Portsmouth Railway Co.

A new enterprise.—I. B. Williams & Sons, of Dover, N. H., are at the present time fitting up and stocking a handsome large store at 722 Arch St., Philadelphia, where they will carry an immense stock of leather belting and lace leather of their own manufacture, together with a complete line of engineers', mine and railroad supplies and power transmission machinery. They will be pleased to receive catalogues of all leading manufacturers of supplies and specialties, on propositions for taking the Philadelph a agency for their products. They have entered into partnership with Messrs. Harry S. Huhn, who was formerly manager of James Smith & Co. for about 19 years, and later with James H. Billington and Wm. J. M. Weaver, who was formerly manager of their supply department for E. F. Houghton & Co., and later for James Smith & Co. The management of this business will be under the direct supervision of the above named gentlemen, both of whom are well and favorably known to the engineers and manufacturers of this city.

One of the best endorsements the France Metallic Packing can have is, that the manufacturer, Mr. A. W. France, Tacony, Philadelphia, has been compelled to engage an extra shift of men, and the works are now running twenty-three hours daily in an endeavor to keep up with the large and ever increasing demand for this metallic packing. The orders are from firms in this country and abroad who have tested it in every way, and have demonstrated to their satisfaction that it meets all requirements.

Mr. France further states that for some time he has realized the necessity of being in a position to supply his customers with all the packing they required, both fibrous and metallic. He now wishes to inform the trade that he is manufacturing high grades of fibrous packing which for effectiveness and wearing qualities, will soon build for itself a reputation equal to that enjoyed by his metallic packing. Catalogue and further information in regard to prices, etc., will be sent upon application.

Cut out the page advertisement of Geo. W. Lord in this issue, fill out as directed and return with a piece of the scale to Mr. Lord He will analyze it and send you a certificate of its composition. Mr. Lord maintains what is doubtless the largest and most complete labratory in the world devoted exclusively to the work of analyzing boiler feed waters and scale. Absolutely no charge is made for this service.

The Pittsburgh Gage & Supply Co., Pittsburgh, have been appointed direct representatives of the Weller Manufactnring Co., Chicago, for their line of elevating, conveying and power transmitting machinery.

The Burt Mfg. Co., of Akron, O., recently made a large shipment of their Cross Oil Filters and Burt Exhaust Heads to Buenos Ayres, Argentine Republic. They report an unusually active foreign trade in their goods, other shipments having been recently sent to England, Austria, Belgium, Mexico and countries in the far East.

The right spirit, discussing the effects of composition in the July number of *Graphite*, the Joseph Dixon Crucible Company make this commendable statement: "When the day comes that Dixon goods are not the best in the market, we will not cut prices but will improve the goods."

A busy man these days is Thos. P. Davidson, the popular Philadelphia machinist, located at 407 Columbia Ave. Mr. Davidson makes a specialty of repairing engines and pumps, boring cylinders and valve seats in position, etc., and in this he enjoys an enviable reputation for turning out good work under all circumstances.

"A good furnace under a boiler is the hardest thing to get about a steam plant," said a prominent engineer recently, "for very few bricklayers know how to build one." If any of our readers have had this same experience, they should try Mr. Wm. C. Hyzer, 1230 Marlborough St., Philadelphia. Mr. Hyzer is an expert in this line and if he cannot give satisfaction, it is a hopeless case.

So many different types of water tube boilers are now built that engineers are sometimes bewildered by the claims of the various makers. However, the Moore boiler, built by the E. J. Moore Machine & Foundry Co., of Philadelphia, possesses several distinctive features that are well worth consideration. A handsome catalogue will be mailed upon request.

The Pilley Packing & Flue Brush Mfg. Co., 308 North Main St., St. Louis, Mo., are manufacturers of several good common sense specialties for saving time, labor and money in the engine room. Their several styles of flue brushes are particularly good, and are probably used more generally than any other. Their packings are equally commendable. Send for catalogue, free.

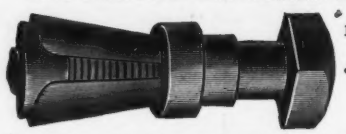
The Way It Goes

"We put up the **Cross Oil Filter** 90 days ago on trial against two other makes of filters. We have given them a thorough test and have kept yours, even though it is higher priced than the others. We believe that this speaks for itself. We are well pleased with it."
C. T. KOENITZ LEATHER CO.,
Cheboygan, Wis.

There's a good reason for paying a trifle more for the **CROSS OIL FILTER.** You'll know this reason if you try a filter 30 days at our expense. "Half saved on lubricating oil bills."

THE BURT MFG. CO., Akron, Ohio, U. S. A.
Largest Manufacturers of Oil Filters in the World
Cross Oil Filters carried in stock by the
FAIRBANKS CO.,
Sole Agents for Philadelphia

THE POSITIVE EXPANSION BOLT



Special Discount to Jobbers. Write for Prices

Manufactured by **D. C. SEAMAN & CO.**
1638 Hutchinson St., Philadelphia, Pa.
For sale by Neal & Brinke, 18 Warren St., New York; Somers, Fiths & Todd Co., 323 Water St., Pittsburgh, Pa.

IF ENGINEERS will send $1.00 to the address below they will receive two blue prints, with tables and instructions, showing how to set valves and eccentrics on Corliss engines, simple and compound, with one and two eccentrics. JOHN T. LINDSTROM, 440 Liberty Street, Allentown, Pa.

DO YOU KNOW

That we manufacture chemical water purifiers that are guaranteed to prevent and remove incrustation in steam boilers, no matter what its composition may be.

CHEMICAL PURIFIERS

that do this without injury to the boiler, its fittings or connections;

CHEMICAL PURIFIERS

that can be used with perfect safety in Breweries, Ice Plants, Dye Works and all places where the water of condensation is used for any purpose.

Write for terms, reports, circulars, etc. We interest you and pay liberal commission. Agents wanted everywhere.

THE PEERLESS SPECIALTY CO.
1720 N. 5th St. and 1711 N. Randolph St.
Philadelphia, Pa.

T. T. Burchfield Co., 619 Arch Street, Philadelphia, have recently installed quite a number of new steam plants, including the Pittsburg Plate Glass Co., with two 100 h. p. Watertown engines, direct connected; E. G. Chester Hosiery Co. one 80 h. p., and the Hotel Agnew, of Atlantic City, 80 h. p.

The Barr Pumping Engine Co. have been awarded the contract for a new sixteen million gallon pumping engine for the water works at Trenton, N. J.

Many Engineers complain of their inability to get a good boiler tube blower; to such, we have no hesitancy in recommending the "Tornado Boiler Tube Cleaner," manufactured by Paul B. Huyette, 1245 Betz Building, Philadelphia. This blower runs a minimum volume of steam with a maximum volume of air, thus insuring a dry tube.

John T. Lindstrom, 440 Liberty Street, Allentown, Pa., informs us that he is receiving a constantly increasing number of orders for his separators for inside of boilers. This separator is an inexpensive apparatus for attaching to end of steam pipe inside the boiler as a protection against water. Mr. Lindstrom has received a number of flattering letters testifying to its efficiency.

Five Cents in postage stamps will bring you a handsome little pocket dice box consisting of five neat little bone dice enclosed in a celluloid box with a mica face. Send stamps to Jas. L. Robertson & Sons, 205 Fulton St., New York.

A Small Sample Can of Garlock belt preservative will be sent free to any of our readers desiring to give it a trial. Address Garlock Packing Co., 604 Arch St., Philadelphia.

H. B. Underwood & Co., of 1025 Hamilton St., Philadelphia, recently completed a rather remarkable job of machine work, which consisted of turning off two 20-inch crank shafts without removing them from their position. These are probably the largest journals ever turned off in position. The job was done for the Saxton Furnace Co., of Saxton, Pa. They also bored out two 50-inch cylinders and made other repairs for the company, completing the entire job in a highly satisfactory manner in less than two weeks time. They also turned off a 10-inch journal for the Bound Brook Woolen Co., of Bound Brook, N. J., and are now estimating for the turning off some much larger journals than any yet attempted, in position.

Your Elevators may get out of order or you may find it necessary to have new ones installed. The Standard Electric and Elevator Co., 116 South Seventeenth Street, Philadelphia, make a specialty of elevator repairs of every description. They also construct and install hydraulic and direct electric passenger and freight elevators, steam, belt and hand power elevators, automatic doors and gates, dumb-waiters, etc.

FOR SALE.—Thompson Steam Engine Indicator, 8 springs, reducing motion and scales. Perfect condition. Price reasonable.
T. D. Brown, 780 N. 26th St., Philadelphia, Pa.

An Expert in his line is always the cheapest and best man to call in when you want a satisfactory job. Mr. Chas. W. Leng, 1213 Filbert Street, Philadelphia, is an expert mechanical engineer. He has had a variety of practical experience in making efficiency tests of boilers, engines and dynamos, and in electrical construction, such as falls to the lot of but few men. All of which has made him the most valuable man of our acquaintance to call in when in need of expert advice concerning steam or electrical apparatus, or when placing a contract for electrical construction work or repairs.

BOWERS BROS. & CO.

Contracting Engineers for HEATING and VENTILATION SYSTEMS, by Steam or Hot Water. FAN SYSTEM. PIPING POWER PLANTS.
Also Manufacturers of GRATE BARS of all descriptions. GENERAL CASTINGS.

1021 REAL ESTATE TRUST BUILDING
PHILADELPHIA, PA.
Phone 8-41-61 D.

YOUR BELTS
YOU DON'T WANT TO RUN TIGHT BELTS. DO YOU?
YOU HAVE TO. WE KNOW YOU DON'T BELIEVE IN BELT DRESSINGS.
WE DON'T BLAME YOU.

BUT YOU WILL BELIEVE IN CLING-SURFACE if you will investigate what it will do.
It penetrates a porous belt and leaves the surface clean—not sticky.
It preserves the belt, stops all slipping, so the belt can run easy under full load. This isn't what we say, it's what our customers say. We will show you if you wish. Get a package, test it, pay only if satisfactory.

CLING-SURFACE MFG. CO.,
185-191 VIRGINIA ST., - - - BUFFALO, N. Y.
NEW YORK—39-41 CORTLAND ST.
PHILADELPHIA—THE BOURSE.

EVERY belt in use loses some of its power by slipping. The only way to restore its grip on the pulley is by reproducing the conditions of a new belt. Dixon's Belt Dressing gives a belt its original freshness, gives it a renewed lease of life, and a renewed hold on the pulley. It doesn't spoil the belt. It improves it and prolongs its life. Sample free.

JOSEPH DIXON CRUCIBLE COMPANY
JERSEY CITY

HORIZONTAL FORM

The Pre-Eminence
OF
Cochrane Separators

is due to the **peculiarly right** construction of the baffle.

If the baffle was placed **too far** from the entry port, a steam cushion might form and allow steam to pass without effective separation. If the baffle was placed **too near** the port, it might cause back pressure and choke the port with steam.

In point of fact however, the baffle is placed at a distance from the entry port, which experience has proved to be **just right.** As a result, the steam strikes the baffle squarely, and, being relieved of the entrained oil, water or other liquid (which is diverted into the well **by the ribbed construction of the baffe**), passes **around the sides** and goes on its way—with no steam cushion, undue friction, back pressure or loss of velocity. Thus a baffle (the most effective separator) is used in the **COCHRANE,** without any of the disadvantages that commonly attend it.

Send for Catalogue 16-S

Harrison Safety Boiler Works
3144 N. Seventeenth St.
PHILADELPHIA, PA.

American Order of Steam Engineers.

ORGANIZED APRIL 27, 1886.

An Order of Engineesr for Engineers and Engineers only.

DECLARATIONS OF PRINCIPLES

Believing that ability will bring its full value in this country, this Order shall at no time take part in strikes, nor in any way interfere between employer and employees. Recognizing their identity of interests, it shall take no part in any project or enterprise that shall interfere with perfect harmony between them ; neither shall it be used for political or religious purposes.

These principles shall not be amended or repealed except by unanimous vote of the Order.

Any member who shall be guilty of violating the principles of the Order shall be expelled.

OBJECTS.

First.—To promote a more thorough knowledge in its members of theoretical and practical steam engineering.

Second.—To assist members to obtain employment.

Third.—To help the sick, injured and distressed and bury the dead.

Fourth.—To establish a Widows' and Orphans' Fund.

Fifth.—To help members who shall become incapacitated from following the profession to obtain employment suited to their affliction.

Sixth.—To do our utmost to extend the license law throughout the United States.

Seventh.—To establish schools in which our members may study the highest branches of steam engineering.

MEMBERSHIP.

An applicant for membership must be an engineer between twenty-one and fifty years of age, and must be a white male citizen of the United States, of good moral character and be a believer in the Supreme Being, and be free from all physical infirmities.

He must have had three years' service in an engineering department, or if a machinist, or graduate of a technical institute, then, one year's service, in such department, and in localities where engineers are required by law to be licensed, they must have such license, and must satisfy the investigating and examining committees of the council to which he applies as to his character and ability.

LIFE MEMBERSHIP.

Engineers who have passed the age limit may be admitted to life membership. They must possess the same qualifications and pass the same examination as are required in the next proceeding clause: They shall be entitled to all rights and privileges of the Order except they cannot vote on financial questions or for the election of officers or be entitled to any sick or death benefits.

DIRECTORY.

The Publication Committee of "The Practical Engineer" desires that the Corresponding Engineers of all Councils of the American Order of Steam Engineers send the name of their Chief Engineer and their own name and address, together with the time and place of meeting to the Secretary of the Publication Committee immediately after each election of officers. Address J. C. McDowell, Secretary, in care of "The Practical Engineer," 1215 Filbert Street, Philadelphia.

SUPREME COUNCIL OF THE UNITED STATES

Supreme Chief Engineer.—Clifford P. Williams, 528 Greenwich St. Phila.

Supreme First Assistant Engineer.—Noah A. Pierson, Fidelity Building, Baltimore, Md.

Supreme Recording Engineer.—Jas. H. Stallings, 3032 Dillon Street, Baltimore, Md.

Supreme Corresponding Engineer.—J. C. McDowell, 1913 South Eighth St., Philadelphia.

Supreme Treasurer Engineer.—Geo. W. Richardson, 3728 Manazambe St., Wissahickon, Phila.

Supreme Senior Master Mechanic.—W. S. Price, Haddon Hall, Atlantic City, N. J.

Supreme Junior Master Mechanic.—Joseph T. Harris, 1611 Clybourn St., Milwaukee, Wis.

Supreme Inside Sentinel.—D. J. Stayton, 1613 West 4th St., Wilmington, Del.

Supreme Outside Sentinel.—H. L. McGee, Baltimore, Md.

Supreme Chaplain.—John T. Dodge, 21 Spring Lane, Boston, Mass.

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Franklin R. Moore, Penna., A. M. Plummer, N. J., and Wm. J. Mitchell, Delaware.

PAST SUPREME CHIEF ENGINEERS.

Jerry Leahey, Jr., Harry G. Connor, Clifford P. Williams, Geo. W. Richardson, Fred W. Moore, N. M. Kinney, James Lightfoot, J. T. Dodge, Jr., Franklin R. Moore.

DELAWARE.

Deputy Supreme Chief Engineer, David J. Stayton, No. 1613 West 4th St., Wilmington.

Wilmington.

Delaware, Council, No. 1, meets every Wednesday at S. E. Cor. Fourth and King Streets. Chief Engineer, W. D. Wyatt. Corresponding Engineer, A. E. Deakyne, 406 Lombard Street.

LOUISIANA.

Deputy Supreme Chief Engineer, John W. Angers.

New Iberia.

Evangeline Council. Chief Engineer, John B. Lanafer. Corresponding Engineer, W. J. Maynard.

MARYLAND.

Baltimore.

Deputy Supreme Chief Engineer, A. J. Deidrich, 226 North Caroline St., Baltimore, Md.

Maryland Council, No. 1, meets 2d and 4th Fridays in Royal Arcanium Hall. Chief Engineer, J. C. W. Schrier. Corresponding Engineer, Wm. S. Smith, 116 W. Lee Street.

Energy Council, No. 2, meets every Wednesday of each month in Bauer Hall, Cheaspeak and Elliott Sts. Chief Engineer, Philip A. Kirkwood. Corresponding Engineer, Jos. H. Stallings 3032 Dillon St.

MASSACHUSETTS.

Deputy Supreme Chief for Eastern District, W. E. Packard, Whitmann.

Boston.

Boston Council, No. 4, meets 2d and 4th Thursday of each month in Templar Hall, 724 Washington Street. Chief Engineer, Harry G. Black. Corresponding Engineer, Wm. T. A. Faulkner, 41 Worcester St.

Orange.

Orange Council, No. 9, Meets 2d and 4th Fridays. Chief Engineer, Chas. Gartrell; Corresponding Engineer, Fred. L. Hale.

Rockland.

Old Colony Council, No. 14, meets second and fourth Saturdays in the American Foresters' Hall. Chief Engineer, E. H. Naylor. Corresponding Engineer, James K. Sedgwick P. O. Box. 333, Rockland, Mass.

NEW JERSEY.

Deputy Supreme Chief, F. O. Garrison, Bridgeton, N. J.

Perth Amboy.

Stevens Council, No. 1, meets third Saturday, at Water, near Lafayette Street. Chief Engineer, Lawrence Oliver. Corresponding Engineer, James H. White.

Camden.

Camden Council, No. 3, meets every Thursday evening at N. E. corner 2d and Federal Street. Chief Engineer, S. R. Middleton. Corresponding Engineer, C. H. Pfeiffer, 671 Berkley St.

Atlantic City.

Atlantic City No. 4 meets every Tuesday evening at Merchants, Cor. Atlantic and New York Avenues. Chief Engineer, R. Endicott. Corresponding Engineer, W. S. Price, Haddon Hall.

Bridgeton.

Bridgeton Council, No. 5, meets every Friday. Chief Engineer, David Sellers. Corresponding Engineer, Francis O. Garrison, Bridgeton, N. J.

Millville.

Millville Council, No. 6, meets every Saturday, 7.30 p. m., in G. A. R. Hall, East Main St. Chief Engineer, Geo. Esabel Corresponding Engineer, Lewis Doughty, 604 Mulberry Street.

NEW YORK.

Syracuse.

John E. Sweet Council, No. 6, meets Monday, Room 23, Nottingham Block, East Washington Street. Chief Engineer, John Cunningham. Corresponding Engineer, S. A. Steel, 311 Orange street.

PENNSYLVANIA.

Grand Chief Engineer, Hiram Trout, 1105 North Tenth street, Reading, Pa. Grand Corresponding Engineer, Frederick Markoe, 931 Orianna street, Philadelphia.

Philadelphia.

Deputy Grand Chief for Western Pennsylvania, A. D. Hamilton, 2025 Forbes Street, Pittsburg, Pa.

Germantown Council No. 22 meets every Wednesday evening at Main and Seymour Streets, Germantown; Chief Engineer, John P. Rickards; Corresponding Engineer, Frank MacIndre, 3529 Ainsley St., Falls of Schuylkill, Philadelphia.

Welcome Council, No. 2, meets every Friday, N. W. Cor. 12th Street and Columbia Avenue. Chief Engineer, Paul Pieling. Corresponding Engineer, L. D. Woodington, 2428 N. Bancroft St.

Kensington Council, No. 3, meets every Thursday, at A. P. A. Hall, Frankford Avenue and Master St. Chief Engineer David J. Ezrah. Corresponding Engineer, Charles Fournier, 3115 Richmond St., Philadelphia.

Southwark Council, No. 4, meets every Monday, at corner of Reed and Eighth Streets. Chief Engineer, Joseph Hynes. Corresponding Engineer, J. C. McDowell, 1913 S. 8th Street.

(Continued on page 28.)

BOILER SCALE

Its Removal; and Reformation Prevented.

TRADE MARK

Did you ever stop to consider that your boiler was not giving the same results as when first installed or that a 1-16th inch scale in your boilers will increase your fuel bill 13 per cent.; a 3-8 inch 50 per cent.? This is not theory; but demonstrated facts. Tests have proven that there is only one way to overcome these conditions, i.e.

BY THE USE OF KEYSTONE TRI-SODIUM PHOSPHATE

AND BOILER COMPOUNDS.

Absolutely guaranteed not only to prevent scale and corrosion, but to remove that which now exists, without injury to the boiler.

REGISTERED

FULLY INDORSED BY THE STEAM BOILER INSURANCE COMPANIES. Our Booklet "Worth Knowing" explains more fully. Free

Keystone Chemical Manufacturing Co. CAMDEN, N. J.

GARLOCK'S

Nineteen Hundred Ring

No. 1900

For Piston and Outside Packed Plungers

There has been a long-felt want for a Packing that would give good satisfaction on Hot Water Rods and especially pumps handling returns from buildings.

We have furnished large amounts of Packing for Hot Water Rods with as good or better satisfaction than other makers. But in our Nineteen Hundred we have a Packing that will outlast any other, many times, and needs little or no attention after once being put in. This packiug is guaranteed to give satisfaction [as are all of our high grades] and a trial will convince you of its merits Made in ring form only; measurements of rod and stuffing box are required.

Garlock's High Pressure Packing

For Marine Work, Locomotives, Very High Steam on Main Piston Rods and Valve Stems, Throttles, Acids, Rods Running in Oil or Grease, Greene Engine Valve Stems, Stop Valves, and Specially Adapted for High Speed.

Style No.
200. Garlock High Pressure Ring
150. Garlock High Pressure Spiral

This packing is especially adapted to **High Pressure Work,** and the construction is without question designed to insure long service.

We are also manufacturers of a general line of standard packings for all purposes

Send for Catalogue and Samples to our Nearest Office

The Garlock Packing Co.

NEW YORK
BOSTON
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PHILADELPHIA
ATLANTA, GA.

NONE GENUINE
TRADE Garlock MARK
WITHOUT IT

PITTSBURG
CLEVELAND
ST. LOUIS
DENVER
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Main Offices and Factories

PALMYRA, N. Y.

IT MEANS WAR

"P.P.P." Packing means war on the old friction-making, power-wasting solid packings. The two kinds never work long together. If you put in "P.P.P." you'll soon put out all solid rod-packings—and you'll stop a great waste of fuel when you do.

DANIEL'S "P.P.P." PACKING

works on a new principle, totally different from that of all other packings (except imitations that infringe our patents). Its sliding wedges adjust themselves to the rod with the least possible pressure, so that it saves both power and packing.

THOMAS CLEGG & Co., Philadelphia, say: "We have a Corliss Engine 16 x 36 in., which we were compelled to pack about every month with the various kinds of packings we have tried. In October, 1897, your Mr. Thompson packed our engine with Daniel's 'P.P.P.,' and we were not compelled to repack until January, 1900."

Get it of your dealer.

FREE—Our patent steel packing rule saves engineers labor, time, trouble, temper, packing, burnt fingers and swear words. It is worth $1.00 Sent absolutely FREE to engineers who order from us enough "P. P. P." for a trial, if they mention this paper.

MANUFACTURED ONLY BY

QUAKER CITY RUBBER CO.

PHILADELPHIA

DIRECTORY OF COUNCILS CONTINUED.

Philadelphia Council, No. 7, meets every Wednesday, at Kenny's Hall, N. W. cor. Broad and Filbert Sts. Chief Engineer, Jas. J. Murphy. Corresponding Engineer, W. S. Wetzler, 3707 Aspen St.

Manayunk Council, No. 9, meets second and fourth Friday evenings in Temperance Hall. Chief Engineer, Richard Wallace. Corresponding Engineer, John Clevenger, 211 Lofty Street.

Helping Hand Council, No. 12, meets every Tuesday evening at Jasper and Huntington Streets. Chief Engineer, Thos. Evans. Corresponding Engineer, Frank McHugh, 2503 Tulip St.

Municipal P. F. D. Council, No. 20, of Philadelphia, meets the second Thursday of each month at Odd Fellows' Hall, Third and Brown Streets. Chief Engineer, Frederick Markoe. Corresponding Engineer, Walter Meyers, 1211 North Howard Street.

Pittsburg.

Iron City Council No. 21 meets every Saturday at 1070 Fifth Avenue. Chief Engineer, Phillip W. Sutton. Corresponding Engineer, F. C. Rose, care of St. Paul's Orphan Asylum, Idlewild, Pa.

Girardville.

Girard Council, No. 8, meets every Tuesday evening at O'Neill's Hall, 2nd and Ogden Sts. Chief Engineer, Jacob Weber. Corresponding Engineer, M. J. Carey, Lock Box 214.

Allentown.

Lehigh Council, No. 15, meets every Wednesday evening at 639 Hamilton St. Chief Engineer, Wm. R. Smith. Corresponding Engineer, A. P. Driesbach, 728 Chew Street.

Pottstown.

Pottstown Council, No. 14, meets first and third Saturday evening at P. O. S. of A. Hall. corner High and Hanover Sts. Chief Engineer, Joseph Rhoads, Corres., Engineer, H. L. Shirey, 862 Cherry St.

Reading.

Progress Council, No. 13, meets every Saturday evening at Diebert Hall, 9th and Penn Sts., Room 4. Chief Engineer, Geo. W. Miller. Corresponding Engineer, Frank S. Miller, 3 W Franklin St.

Chester.

Delaware County Council, No. 6, meets every Wednesday evening in the Carpenter Hall, 6th and Wall St. Chief Engineer, John Canavan. Corresponding Engineer, E. E. McCoy, 2222 West 3d Street.

York.

York Council, No. 16, meets every Wednesday evening in the Jordan Block. Chief Engineer, F. Seyler. Corresponding Engineer, Walter H. Long, 23 East Philadelphia Street.

Harrisburg.

Capitol City Council, No. 17, meets every Tuesday evening in Red Men's Hall, Market Street, above Second. Chief Engineer, B. H. Shafer. Corresponding Engineer, S. Filson, 1126 Market Street.

Columbia.

Columbia Council, No. 18, meets every first and third Saturdays, in Odd Fellows' Hall. Chief Engineer, Ruben Beard. Corresponding Engineer, W. J. Courtney, 804 Walnut Street.

Sunbury.

Sunbury Council, No. 19, meets every second and fourth Saturday in Zartman's Hall. Chief Engineer, S. E. Lees. Corresponding Engineer, Ed. Schrieber.

WISCONSIN.

Deputy Supreme Chief Engineer, Joseph P. Harris, No. 1611 Clybourn Street, Milwaukee.

Milwaukee.

Washington Council, No. 1, meets every Saturday at 207 Grand Avenue. Chief Engineer, J. B. Chambers. Corresponding Engineer, James A. Rigby, 136 Reed Street.

Clifford P. Williams Council, No. 2, meets every Thursday evening 298 4th Street. Chief Engineer, David T. Richardson. Corresponding Engineer, Jas. T. Harris, 1611 Clybourn Street.

TENNESSEE.

Deputy Supreme Chief Engineer, John B. Mullen, 826 Central Ave., Nashville.

Nashville.

Enterprise Council, No. 1. meets every Friday evening in the Twin Building on Cedar St. Chief Engineer, J. J. Johnson. Corresponding Engineer, Jno. B. Mullen, 209 Jackson Building.

OREGON.

Deputy Supreme Chief Engineer, Nat Freese, Grant's Pass, Oregon.

Grant's Pass.

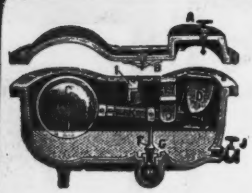
Oregon Council No. 1. Chief Engineer, William H. Kenny. Corresponding Engineer, Nat Freese. Meets every first and third Saturday. A. O. U. W. Hall, Main St.

TEXAS.

Deputy Supreme Chief Engineer, S. A. Bishery, care of Cotton Compress and Warehouse Co., Galveston.

Galveston.

Galveston Council No. 1 meets every second and fourth Tuesday evening at Engineers Hall, So. West corner 22nd and Strand Streets Chief Engineer, Max Levy; Corresponding Engineer, A. L. Bradford, Union Depot.



McDaniel Steam Traps

Always have a Water Seal over the valve and never blow steam; neither do they back up water

REDUCING VALVES
EXHAUST PIPE HEADS,
EJECTORS, RELIEF VALVES,
GREASE EXTRACTORS,
STEAM SEPARATORS, etc.

Watson & McDaniel Co.

MANUFACTURERS

Send for 1902 Catalogue

147 N. Seventh Street

For sale by the Jobbing Trade

CRANE VALVES

ESTABLISHED 1855

RED SEAL BOILER COMPOUND...

WILL REMOVE SCALE, GREASE AND DIRT FROM STEAM BOILERS - - -

RED SEAL BOILER COMPOUND

Saves fuel; purifies the water; prolongs the life of the boiler; prepares the water to make pure steam. Its action on old scale is gradual but certain. Prevents grooving, pitting and wasting of iron. Does not injure or corrode the iron. Contains no acids.

Manufactured by

THE CHERRY CHEMICAL CO.

OFFICE: 1215 FILBERT ST., PHILADELPHIA, PENNA.

Circulars, Prices and Directions Furnished on Application.

THE PULVER

MADE THE BEST

AUTOMATIC IN ACTION

QUALITY NEVER CHANGES

WILL NOT DRIP

WILL NOT FREEZE

TESTING SAMPLE FREE.

SEND FOR CATALOGUE.

WORKS THE BEST IS THE BEST

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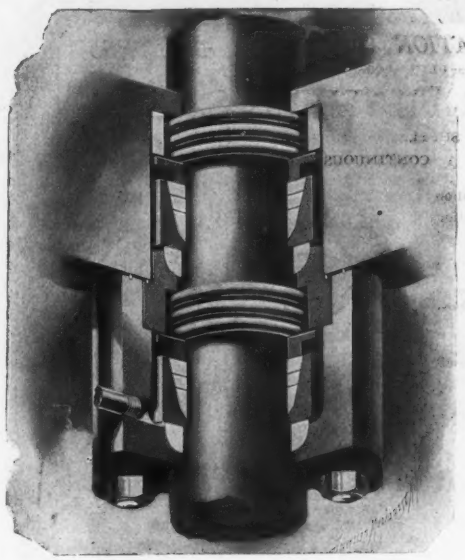

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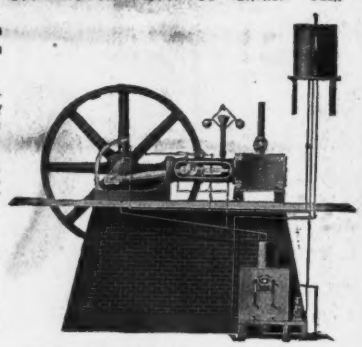

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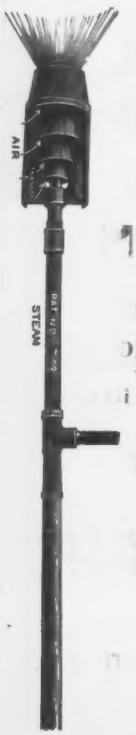

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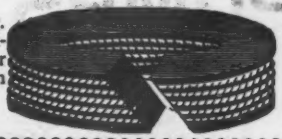

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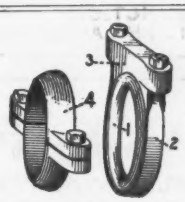

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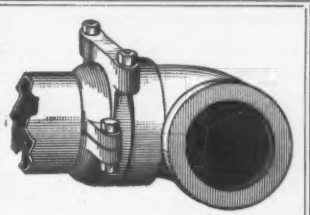

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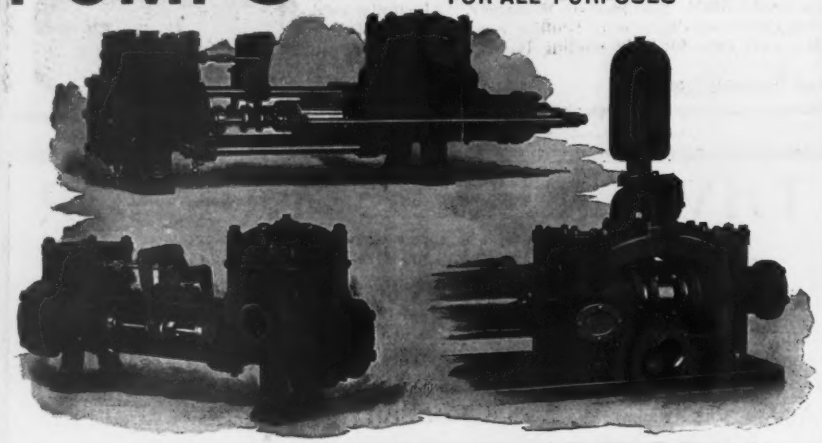

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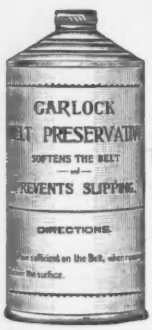

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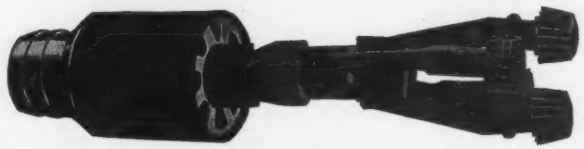

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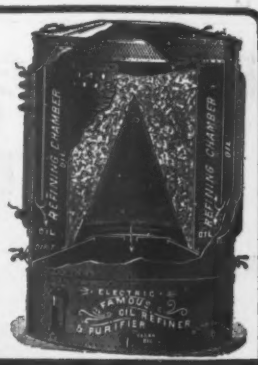

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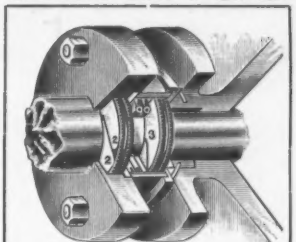

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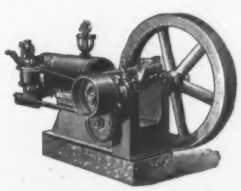

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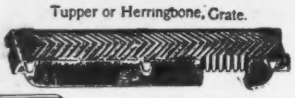

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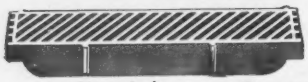

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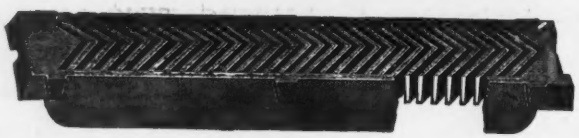

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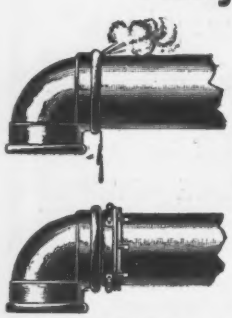

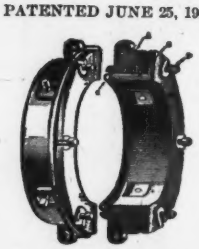

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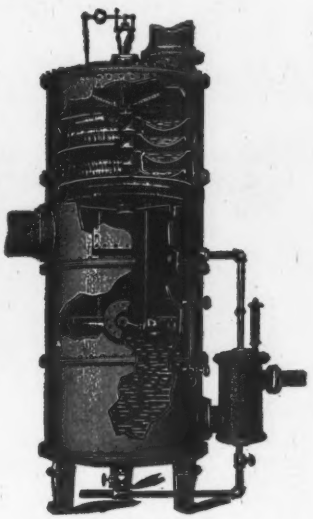

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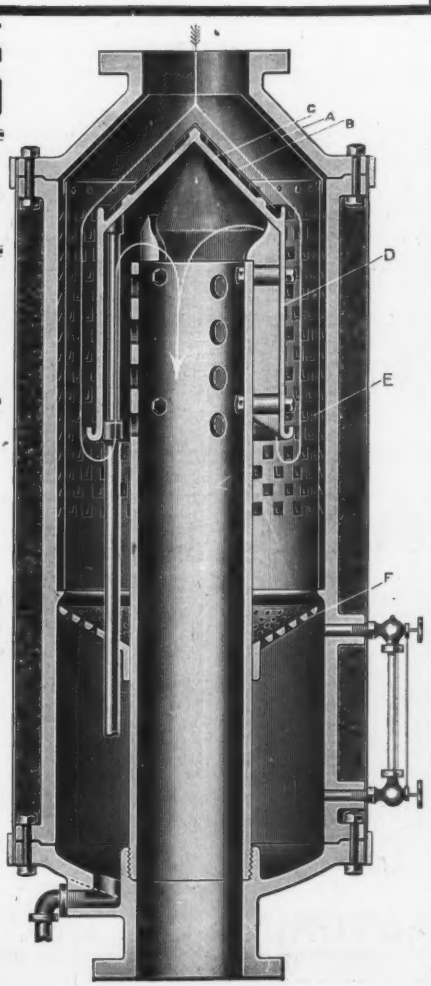

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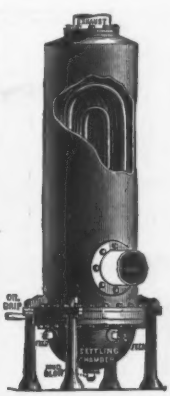

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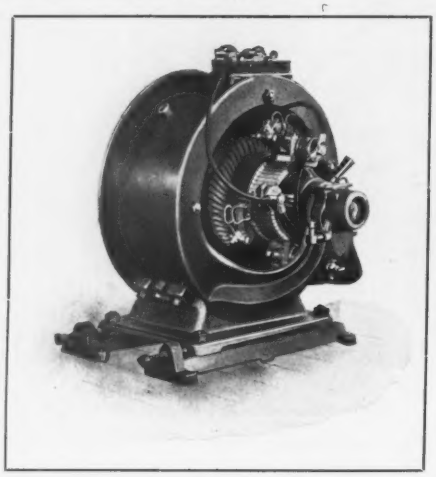

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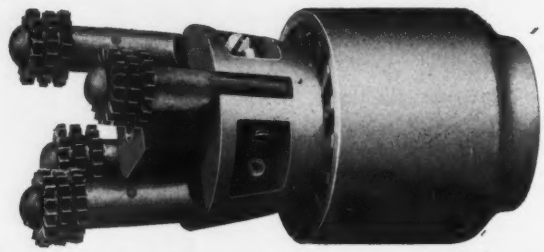

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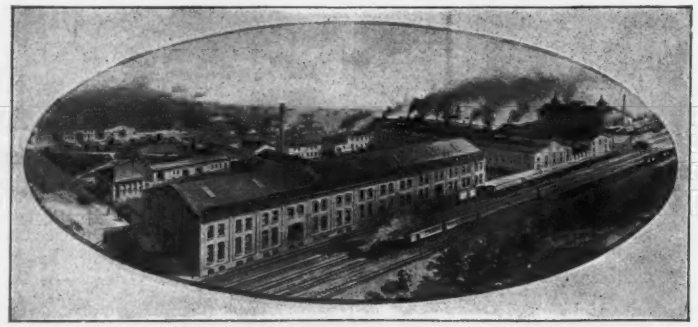

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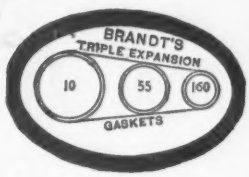

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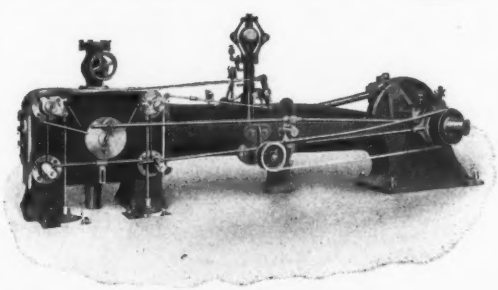

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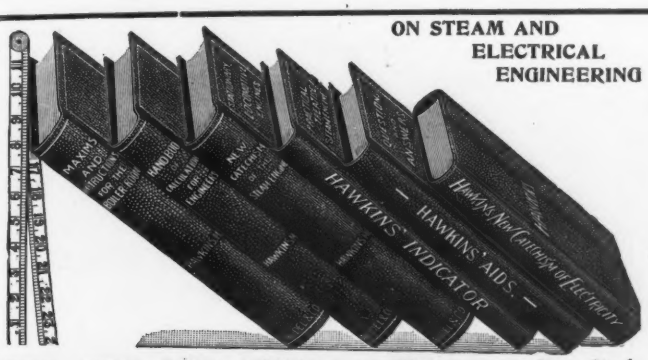

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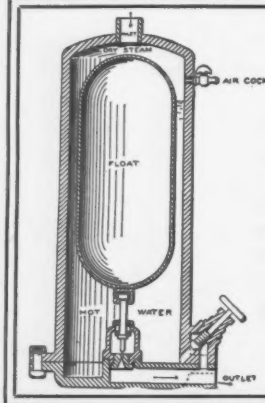

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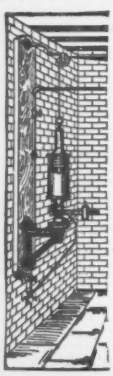

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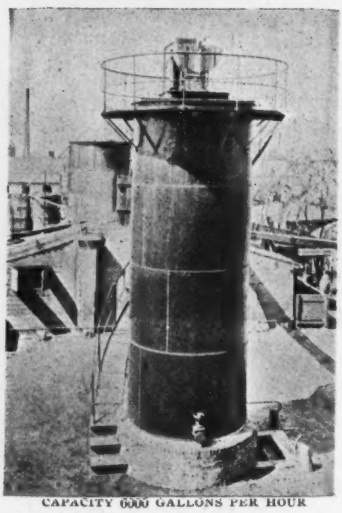

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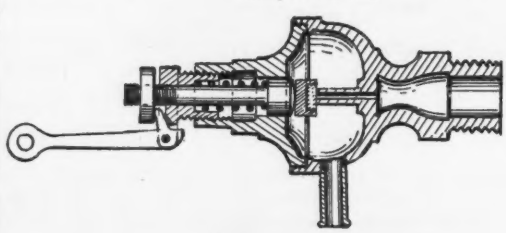

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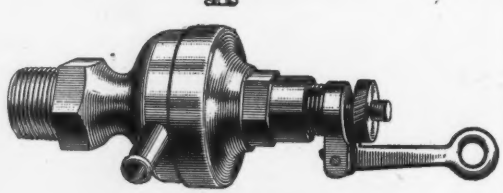

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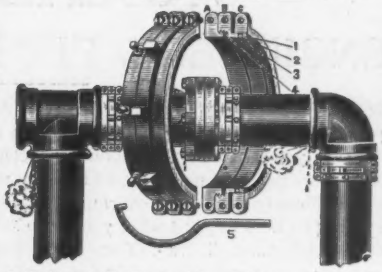

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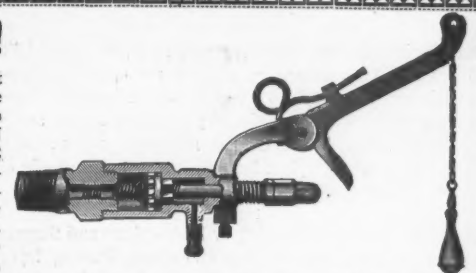

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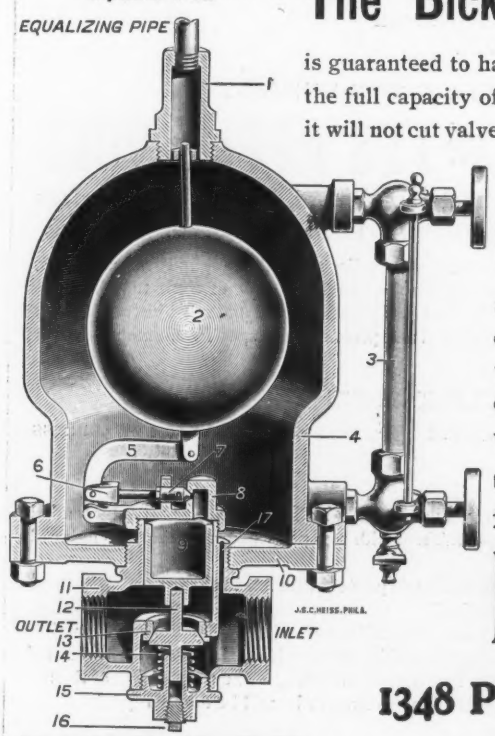

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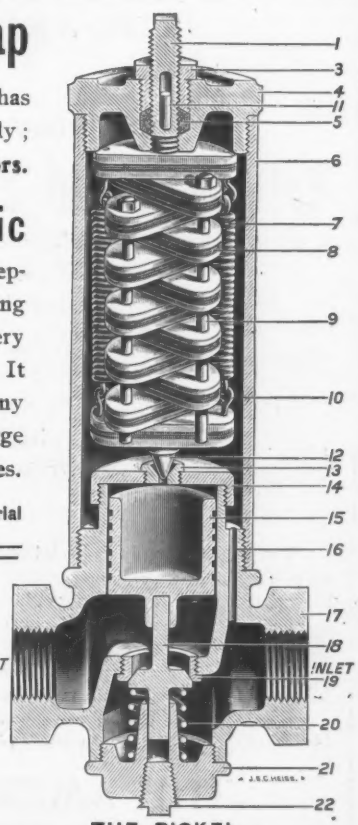

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Let every engineer make his own indicator book as he proceeds in his study and practice, and it will prove invaluable in after years. The present work has been compiled in this way, from data continually obtained during the author's professional career, extending over a third of a century.

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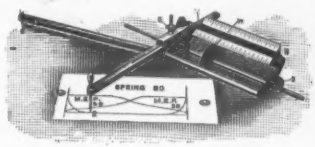

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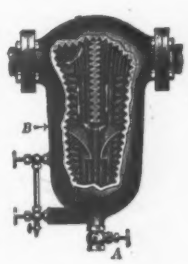

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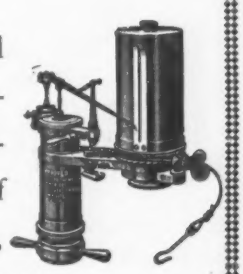

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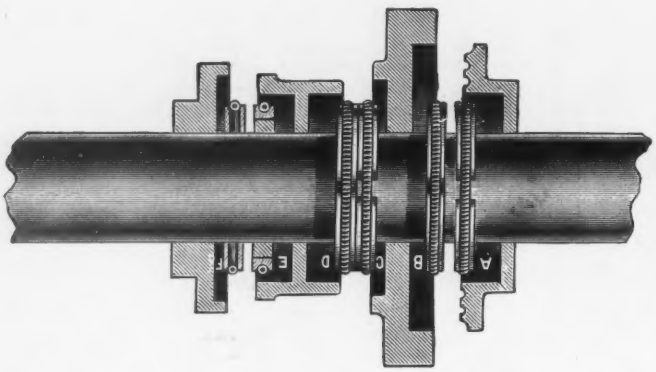

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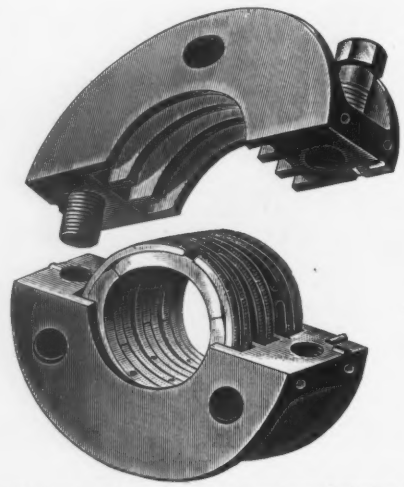


Recently, other persons have been manufacturing a case similar to the above and offering it for sale. We hereby give notice that we are the patentees and sole owners of Patents covering this case, No. 525,434, issued September 4, 1894.

WE have been manufacturing Metallic Packing for twenty years with absolute satisfaction to our many thousands of customers. There are 100,000 of these packings in use among the largest manufacturing establishments in the world.

This Packing can be applied to engines without disconnecting any part of engine. Perfectly steam tight when working under highest steam pressure, and absolutely vacuum tight.

THOS. WALKER & SONS

4617-21 TACONY STREET - - - FRANKFORD, PHILADELPHIA, PA.

Branch Office: 128 Massachusetts Ave., Allegheny City, Pa.

40 Per Cent Saved

PILLEY'S EXPANSION WEDGE PACKING

See that this trade mark is on all Pilley's Packings

THE ONLY PACKING HAVING A PERFECT EXPANSION AND PRACTICAL WEDGE
MADE IN 12-FOOT LENGTHS OR

CUT AND MOULDED INTO RINGS
TO FIT YOUR RODS

This is the most economical wedge packing on the market, and as it is not **loaded** with **unnecessary** Oil and Tallow it weighs about one-half per foot of other wedge packing, thus making a saving of fully 40 per cent in cost of packing

Also Sole Manufacturers of

PILLEY'S IMPROVED RING PACKING

Sent on Thirty Days' Trial to Responsible Parties

Latest and Best

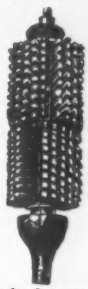
Showing Construction of Brush

A RECORD FOR RELIABILITY IS BEHIND THE IMPROVED

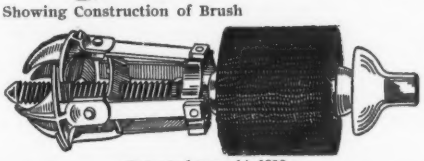
Pilley Expansion Flue Brush

It Is Guaranteed Not to Break, Being made of Malleable Iron and Tempered Steel

It Cleans the Entire Flue Every Time it is Pushed Through



Brush ready for use



Patented June 14, 1892

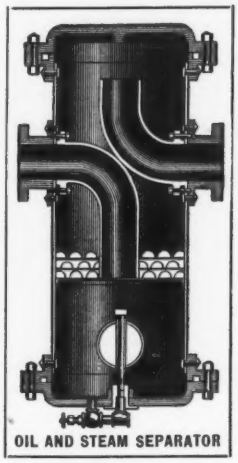
Keep your tubes clean and save money. **Pilley's Combination Flue Brush and Scraper** is the simplest and best cleaner on the market. A simple turn of the hand adjusts it to the tube and the brush removes what the scraper loosens. Guaranteed not to break nor the wires to come out or lay over. Sizes from 2 inches up. Measure outside diameter of tube.

PILLEY PACKING AND FLUE BRUSH MFG. COMPANY, 308 N. Main St., St. Louis, Mo.

——For Sale by——

Tatum and Bowen, San Francisco, Cal; Portland, Ore., and Seattle, Wash. Crane Co., New York City. Thomas Fielding, Denver, Colo. Eagle Oil and Supply Co., Boston, Mass. Chas. Bond, 622 Arch St., Philadelphia, Pa. Scranton Mercantile Co., Scranton, Pa. Strong Machinery and Supply Co., New York City. New Orleans Railway and Supply Co., New Orleans, La. **Send for Our 70-Page Memorandum Book—FREE TO ENGINEERS**

The LINDSTROM Steam and Oil Separators



OIL AND STEAM SEPARATOR

Will keep the water in your Boiler.
Will reduce the moisture ¾ of 1 per cent.
Will stop the priming in your boiler.
Impossible to get water over to Engine from Boiler.

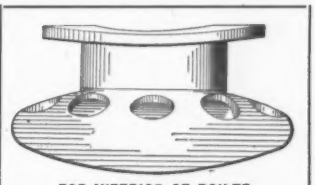
It pays to remove the Oil from Exhaust Steam.

WRITE FOR CATALOGUE.

Cylinders Re-bored in their present positions. From 4 inches to 70 inches.

ALL KINDS OF STEAM ENGINE AND STEAM PUMP REPAIRS. GENERAL AND SPECIAL HIGH GRADE MACHINE WORK.

SEND FOR PARTICULARS AND PRICES



FOR INTERIOR OF BOILER

Hoopeston Electric Light & Heating Co.
Hoopeston, Ill., May 12, 1902.
Mr. John T. Lindstrom, Allentown, Pa.
Dear Sir—We have two of your Separators on our two 60" boilers, and find that they are very much improved by them; they were formally very wet, steaming, and gave us considerable trouble with water in our engines. This trouble has entirely disappeared since we put in your Separator. Very truly yours,
Hoopeston Electric Light & Heating Co.
C. J. WAKEMAN, President.

John T. Lindstrom

440 Liberty Street - - - Allentown, Penna.

HOUGHTON'S MONTHLY LETTER TO ENGINEERS

DEAR MR. ENGINEER:

If you want to make a hit with the Boss, you will have to save him money.

Now don't think he won't appreciate it.

He is not going to "swell your head" until you are too large for your position.

You must remember he is a keen business man and appreciates the management of men.

But he will appreciate your efforts, all right.

And you can obtain a responsible demonstration of his appreciation by increased pay.

But don't expect the pay the very next day.

Remember, the Boss has seen things that look nice on the start, but which did not pan out a paying investment, and he is naturally and wisely sceptical.

Just plug right ahead and fight for the saving.

Then, when you demonstrate the saving, the reward will come.

It is just such fighters for economy that have risen not only to the very highest ranks among the engineering profession, but who have gone still further up the ladder to proprietorship.

It may seem hard for you to think that you have to fight to save the boss money, but remember, that if the boss said "Yes" to every proposition that promised to save him money, he would be broke in a year.

If you want to make a most elegant and safe demonstration of a large saving, study the principles and application of the MARCK STEAM TRAP.

Begin right away by sending in an application for one of the new trap catalogues which are about going to press. This won't cost you a single cent, nor your boss either.

Then, if the catalogue does not give you what you want, send us particulars, drawings if you want, and our engineers will put you right.

That won't cost either you or the boss a cent.

Then order as many traps as you may see fit.

They won't cost you or the boss a cent until they have proven their saving.

In other words, we give you 30 days in which to test the merits of the MARCK STEAM TRAP before asking you to say to the Boss, "They are all right." If they are not all right, you can return them at our expense, and we will cancel the charge.

Not one cent of expense in this to anyone but ourselves.

If they are all right, we shall expect our bill paid and then we will guarantee the traps for two years.

Now here is a chance to make a demonstration of a saving at our expense and risk.

No danger of having the boss scowl, hesitate for fear of loss, etc.

Not one cent asked until the traps are in and working and doing just what we claim they will do.

Now you ought to accept this offer for other reasons than this mere saving which can be affected upon traps.

You should accept it for your future's sake.

When the Boss sees how much you can save him with these traps, he will reason that you have not had your own way sufficiently, and other savings where the sellers are not so liberal in their offers as we are will be more easily effected.

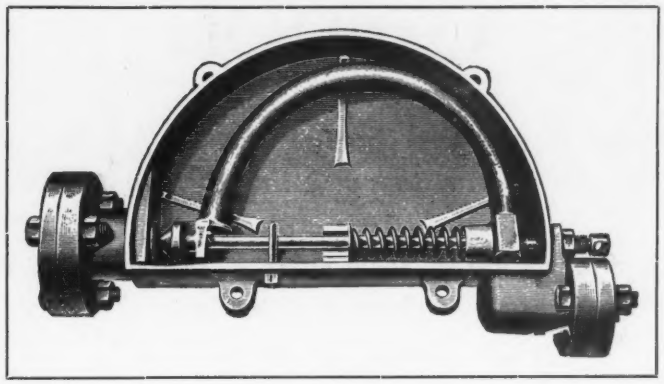
The first thing to do is to get your name down on the list for the new catalogue.

Yours respectfully,

E. F. Houghton & Company

240-250 W. Somerset Street PHILADELPHIA

175 - 177 Lake Street CHICAGO



The coal you don't burn

is clean, clear profit. You double that profit the day you put the Heintz Steam Saver in your plant.

It saves two tons where other traps save one, and still it saves, when other traps are done.

THE HEINTZ STEAM SAVER

only wants a chance to get its nose inside your door, like the camel in the story; it will take care of the rest. For example, Mr. G. M. Brill, the well-known car-builder, said at first, "There isn't a place in our establishment where we could use your trap." All the same, he is now using over **one hundred** of them in that same establishment. As soon as people find out what one of the Heintz Savers saves, they soon find places for more. Look out for imitations.

The Heintz Steam Saver is made in nine sizes, capacity one quart to 240 gallons a minute. Any size sent on 30 days trial; no charge unless satisfactory. Guaranteed for one year.

WILLIAM S. HAINES COMPANY

136 SOUTH FOURTH STREET PHILADELPHIA

HF

NONPAREIL CORK

PIPE COVERING

HAS THE HIGHEST EFFICIENCY FOR KEEPING IN COLD OR HEAT

Best Covering made for either Steam, Water or Brine Pipes. This has been proven in every competitive test.

Nonpareil Cork Cement is the most efficient plastic covering. Non-corrosive, durable and light.

Nonpareil Sheet Cork is unequalled for cold storage insulation or other large flat surfaces.

Nonpareil Cork Flooring and Tiling is practically indestructible and a perfect non-conductor of sound.

JOHN R. LIVEZEY
120 SOUTH TWENTIETH STREET
PHILADELPHIA

The Nonpareil Cork Mfg. Co.
Girken Building
Chambers St. and W. Broadway NEW YORK

A FAIR PROPOSITION

WE know beyond question that our method of preparing Chemicals specially for each feed-water is the proper one; therefore we are so persistent in asking engineers to send us samples of scale for analysis.

If you have any scale in your boilers and would like to know what it consists of, kindly answer the questions below and send us a small sample, enclosed in this sheet. There is no charge for the analysis.

How many boilers have you?.....

State capacity of each boiler.....

How often do you clean boilers?.....

Do you blow out or wash out all sediment each time?.....

How often do you open the blow-off while at work?.....

How long do you keep it open?.....

Name the river or source of your water supply.....

Does the feed-pipe clog up or form scale?.....

Do you use a heater?.....

Do you run day and night?.....

If samples of scale are sent in separate packages, please mark same with your name and address.

Your name.....

Address.....

Firm name.....

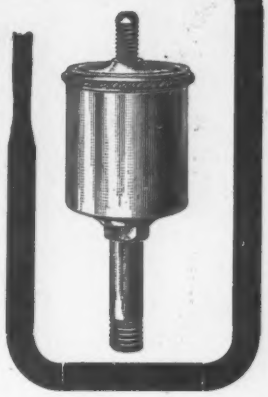
Mail this to

GEO. W. LORD

2238-50 N 9th St., Philadelphia, Pa.

SOLE MANUFACTURER, LORD'S BOILER COMPOUNDS

See This Grease Cup!



WE have a number of Brass Grease Cups on hand just like it. If you'll drop us a line one will be

Sent Free, Expressage Prepaid,

to your address, and a large can of

KEYSTONE GREASE

will come along with it—as we want you to test the superior qualities of Keystone Grease as a lubricant.

Now, Mr. Engineer, you know the value of a good lubricant during these warm August days. The ideal lubricant should not only reduce friction to the lowest minimum point, and not waste away by dripping or leave a residue to cake and clog bearings; but it should always give the same result in any temperature.

Oil wastes very rapidly in warm weather, and is apt to give more than the usual amount of trouble to keep the bearings cool, besides it's dirty.

There's never any difficulty where **Keystone Grease** is properly applied. It's not a substitute for oil, but an improvement upon every other agent used for lubricating purposes—it won't waste away or drip it and gives far better results than the best grades of oil, and will very materially reduce the cost of lubrication, as

ONE BARREL OF KEYSTONE GREASE WILL OUTLAST THREE BARRELS OF OIL

Let us send you the sample to test—you can then prove to your satisfaction that our assertions are positively true.

Keystone Lubricating Co.

20th and Alleghany Avenue
PHILADELPHIA, PA.

Keystone Grease is Not Sold by Jobbers

PLATE I. R. B.

MOORE'S HIGH PRESSURE SAFETY STEAM BOILERS, PHILADELPHIA. 800,000 H. P. in use, both in Europe and America

Repairs of Water Tubes. Boilers of all types a specialty. We have special tools for this purpose. TELEPHONE 1-55-82-A
We keep constantly on hand ready for shipment 1000 horse-power. There can be no delay. **Send for Catalogue.**

ESTABLISHED 1864 PHONE

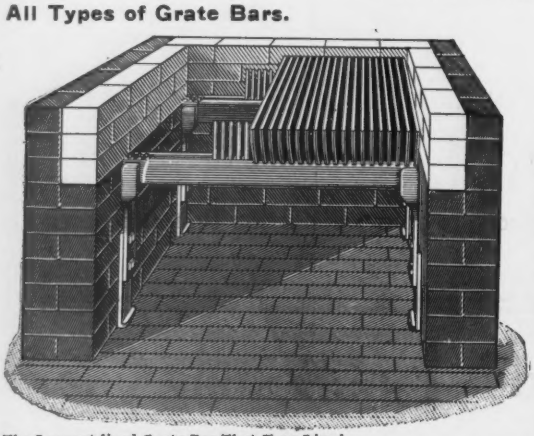
E. J. Moore Machine & Foundry Co.

MACHINISTS, FOUNDERS & PATTERN MAKERS

Gray-White, Semi-Steel Aluminum Alloy Castings. Mills and Pulverizers for Minerals, Cereals, &c.
Stamping and Embossing Presses, Roller Mills.

2227-2235 WOOD STREET

All Types of Grate Bars. **PHILADELPHIA, PA., U. S. A.**



The Longest-lived Grate Bar That Ever Lived.
Call Your Engineer's Attention To This Bar

IMPROVED AMERICAN GRATE BARS

PATENTED.

THE ONLY GRATE WITH ADJUSTABLE FRAME.
THE ONLY GRATE WITH LOOSE TEETH BETWEEN THE BARS.

We wish to call your attention to a few important points in our new Furnace Grates.

The adjustable supporting frame, not coming in contact with the brick-work, saves the walls from getting loose, and can be adjusted to any height desired. The perforated supporting cross bar has less obstruction to a free circulation of air than any other Cross Bar made. The movable teeth between the Grate bars can easily be changed at any time, so as to give an air space between the bars that is desired to accommodate any size of fuel; the Movable Teeth also give the bars more freedom to expand and contract, thereby the bars are less liable to warp.

The American Grate Bars have given satisfaction where others have failed. Are made and for sale only by us; other parties have no right to make or sell them. **Send for circular and references.**

E. J. MOORE MACHINE and FOUNDRY CO.,
SOLE MANUFACTURERS,
Delivered F. O. B. PHILADELPHIA, U. S. A.

WE CALL ATTENTION TO BUT A FEW CUSTOMERS OMITTING OUR FOREIGN AGENTS AND OTHERS

Holyoke Water Power Co.	Holyoke, Mass.	Florence Manufacturing Co.	Florence, Mass.
Parsons Paper Co.	" "	Fairfield Paper Co.	Westfield, Mass.
Parsons Paper Co. Mt. Tom Mill	" "	Thompson, Houston Electric Light Co.	
Whiting Paper Co. No. 1	" "		Yonkers, N. Y.
Whiting Paper Co. No. 2	" "	Stewart & Carmichael	Amsterdam, N. Y.
Whiting Paper Co.	North Wilbraham, Mass.	Wesleyan Academy	Wilbraham, Mass.
D. Mackintosh & Sons	Holyoke, Mass.	Parker & Whipple	Meriden, Conn.
Valley Paper Co.	" "	Montague Paper Co.	Turners Falls, Mass.
Albion Paper Co.	" "	Lamb Knitting Machine Co.	Chicopee Falls
Nonotuck Paper Co.	" "	Wagman, Thorp & Co.	" "
Winona Paper Co.	" "	Betz Building	Philadelphia, Pa.
Lyman Mills	" "	New England Fibre Co.	Turners Falls, Mass.
Hadley Mills	" "	Young, Smyth, Field & Co.	Philadelpnia, Pa.
Chemical Paper Co.	" "	Derby & Weatherby	" "
Franklin Paper Co.	" "	Colonade Hotel	" "
Union Paper Co.	" "	John P. Holt's Mill	" "
Germania Mills	" "	Beatty Bros.	" "
Springfield Blanket Co.	" "	Nixon's Paper	" "
Wauregan Paper Co.	" "	John Dunlap & Sons' Mill	" "
Massasoit Paper Co.	" "	Paxson, Comfort & Co.	" "
D. F. Coghlan	" "	Taylor & Bro.	" "
Merrick Lumber Co.	" "	Joseph Campbell	" "
St. Jerome Catholic Church	" "	Phillip S. Maloney	" "
City Hall	" "	Jonn C. Miller's Brewery	" "
Beebe & Holbrook Paper Co.	" "	Harrison Boiler Works	" "
Syms & Dudley Paper Co.	" "	R. I. Walker Finishing Works	" "
Crocker M'f'g Co.	" "	W. J. McCann & Co. Sugar Ref.	" "
Public Schools	" "	Adams Express Co.	" "
Beebe, Webber & Co.	" "	Lancaster Caramel Co.	" "
Prentiss, Brooks & Co.	" "	Baugh & Sons Fertilizer Co.	" "
Tuttle Rubber Works	" "	Henry Goldner Boiler Works	" "
Farr Alapaca Co.	" "	Philip Klein & Son Brewery	" "
New York Woolen Co.	" "	Philadelphia Galvanizing Co.	" "
Holyoke House	" "	Beswick & Kay	" "
Hampshire Paper Co.	So. Hadley Falls	Lewis Thompson & Co.	" "
Glasgow Co.	" "	Saturday Night Paper	" "
Agawam Paper Co.	Mittineague, Mass.	Sharpless Bros., 8th & Chestnut	" "
James Ramage Paper Co.	Monroe Bridge, Mass.	Sharpless Bros., 812 Market St.	" "
R. M. & Theo Reynolds	Monson, Mass.	John Mundell & Co.	" "
F. G. Tilton	Ft. Edward, N. Y.	H. O. Wilbur & Sons	" "
F. H. Whittlesey	Windsor Locks, Conn.	Commercial Bank	" "
German-American School Asso.	Meriden, Conn.	Blockley Almshouse	" "
Anchor Hosiery Mills	Cohoes, N. Y.	Croft & Allen, Candy Manfrs.	" "
D. A. Bullard & Sons	Schuylerville, N. Y.		

We are the Originators, not Imitators

and the general verdict is that

Perry's Red and Brown Sheet Packings

are the only old and original goods now offered to the trade, and that PERRY'S SPECIALTIES in Steam Packings, for all purposes, are made upon honor and have no superiors.

TRY THEM

Manufactured by the **La Favorite Rubber Mfg. Company**

PATERSON, N. J.

Makes Perfect Joint Instantly

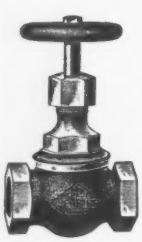
JENKINS '96 PACKING does not require to be heated to complete the joint, and can be used for cold joints as well as hot. It will pack joints with rough surfaces equally as well as when they are faced. **IT DOES NOT DETERIORATE WITH AGE.** It will last as long as the metals which hold it under all conditions of service on steam, ammonia, oils, acids, etc. Do not accept unless stamped like cut.

JENKINS GASKET TUBING

is made from a compound somewhat similar to the Jenkins '96 Packing. It is suitable for steam joints, hand holes and man holes. It is handy and economical, and is giving the best of satisfaction. It is made ⅜", ½", ⅝" and ¾" in diameter in lengths of about 12 ft. Packed in boxes weighing 4 to 6 pounds.

JENKINS PUMP VALVES

We make valves adapted for all conditions of service. It is our constant aim to produce the best, regardless of cost. Like all our specialties, they are guaranteed to give entire satisfaction. When ordering, state diameter, thickness and size of hole; also in what service they are to be used.



Jenkins Bros. Valves

The universal popularity which these valves have attained is proof of their superior qualities. They give good service under the severest conditions. They are the only valves which have the **Jenkins Patent Keyed Stuffing Box,** which holds packing securely and prevents leakage around the spindle, and the **Jenkins Disc Removing Lock Nut,** which not only locks the disc nut, but assists in removing the disc when necessary for repairs. They can be packed when under pressure with valve wide open. The improved **Jenkins Disc** used in these valves is made in the most careful manner, and will stand high pressure steam, oils, acids, ammonia, etc. **Accept no Imitations.** Remember the genuine are always stamped with our Trade Mark, and are fully guaranteed.

"Jenkins Bros. Valves, '96 Packing and Rubber Specialties received highest awards at the Pan-American Exposition."

Send for a Copy of our 1901 Catalogue

JENKINS BROTHERS, 133-35-37 North 7th Street, Philadelphia
71 John St., New York. 17 Pearl St., Boston. 31-33 North Canal St., Chicago. 62 Watling St., Queen Victoria Street, London, E. C.